NOVEMBER 21, 1936

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# ELECTRICAL WORLD

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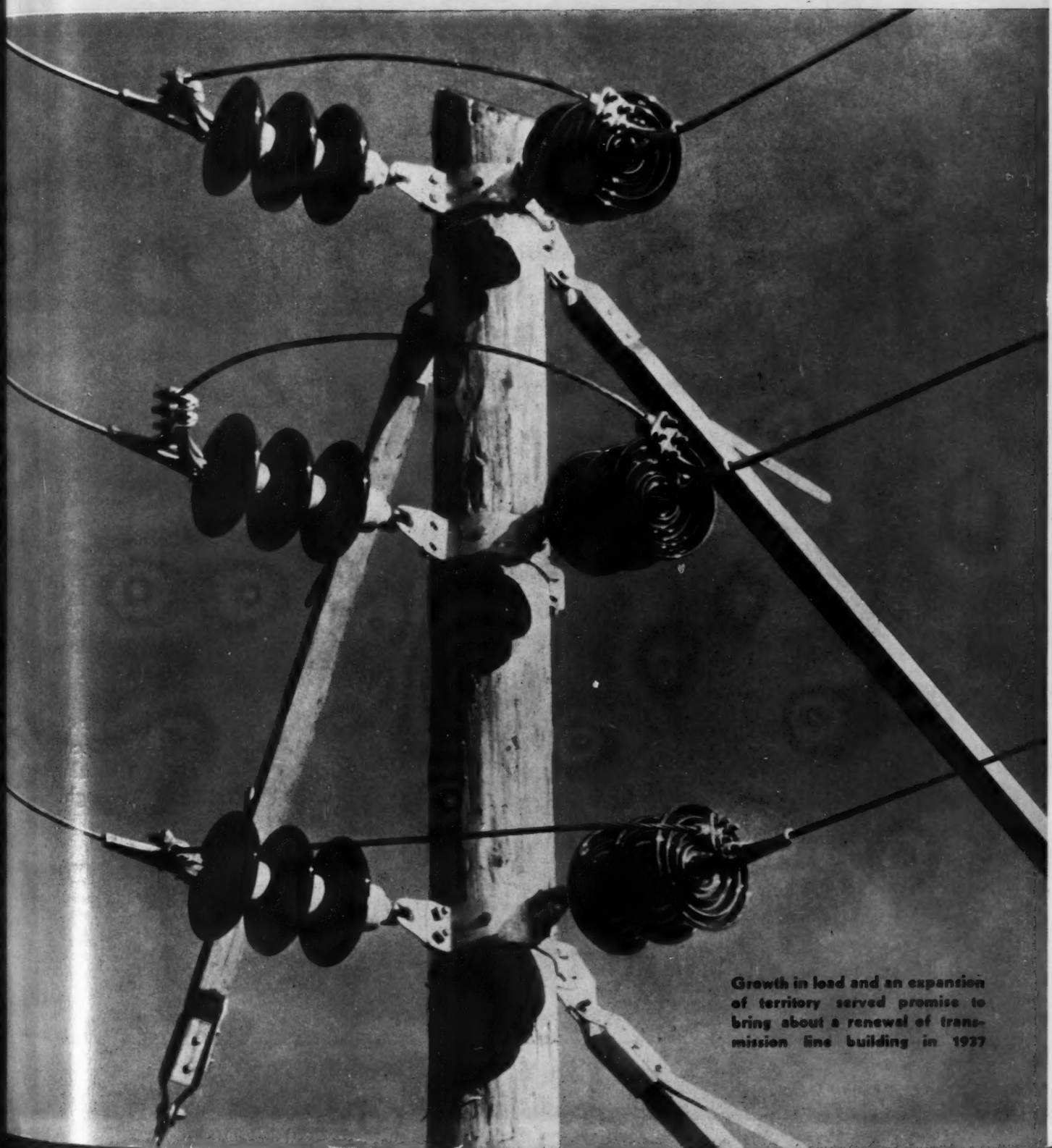

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## Coming Features

**Control of Short-Circuit Kva. Cuts Operating Costs**

H. C. Tice is soon to tell how the Southern California Edison Company used well-planned sectionalizing to improve stability, eliminate breaker failure and simplify dispatching.

•

**Welder Energy a Service Problem**

A few unrestrained welders can do plenty to distribution system regulation. Detroit Edison's A. L. Lane is going to tell how one utility company handles the welder situation.

•

**What Does It Cost to Sell Ranges**

The answer to the above question will appear in ELECTRICAL WORLD soon. It is based on replies of a selected group of utility companies to four questions about their range sales.

•

**Pumps Water From Underpasses**

Michigan motorists are kept moving on wet days by electric pumping facilities that keep depressed highways free from floodwaters. Details of the installations are to be told soon.

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**On the Cover**

Our cover picture is by Frank Maggard of the Kansas City Power & Light Company. It shows engineering talent shining in photography.

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NEWS OF THE WEEK

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# Letters TO THE EDITOR

## *Tool Electrification Butts Starting Rules*

*To the Editor of* ELECTRICAL WORLD:

The question of increased starting and reversing currents on machine tools raised in your editorial of September 12 is a timely one. It has been recognized that metal planers with modern drives use electrical reversing and little or no objection is raised when a 50-hp. motor is reversed ten or fifteen times a minute on short stroke planer work. However, a lathe builder is handicapped by limitations in starting current when he seeks to apply the principle of electric starting and reversing to his machines. A full-voltage reversing and plug stop lathe controller has a cost that compares with the mechanical clutch, brake and reverse gear. Even a resistance type of controller offers advantages over the mechanical drive which will justify an increased cost. On large lathes the increased cost of the electrical equipment due to the starting limitations has tended to limit the field of application of electric drive.

There is a definite relation between starting current and starting torque and many machine tool functions such as rapid reversing, work handling, clamping, rapid transverse and feed motions require high starting torques. Most of these motions require a relatively small amount of power, but increased production on machine tools must always be accompanied by an increase in the electric power requirements.

Electrification of machine tools offers many advantages to the user and the manufacturer of the machine. From a load-building viewpoint this trend toward complete electrification of machine tools should be desirable to the utilities. I wish to thank you for bringing this timely question out in the open and I hope that your editorial will invite further comments.

R. S. ELBERTY,
Machinery Electrification,
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa.

•

## *Could Use Non-Sticking Contacts*

*To the Editor of* ELECTRICAL WORLD:

In the September 12 issue of ELECTRICAL WORLD (page 80) there is an article under the heading of "Sticking Contacts Easily Cured."

Undoubtedly the solution that is suggested will find occasional application, but we consider it advisable to call attention to the fact that the modern method for eliminating sticking contacts is to use contact material that will not stick.

Especially on control apparatus up to a rating of 100 or 150 amp. all voltages, the use of copper to copper or bronze to copper has become obsolete by the use of cadmium silver contacts. Such contacts may oxidize, but such oxide can in no way interfere with the satisfactory and reliable operation of the contacts in question.

F. F. LOOCK,
General Manager
Allen-Bradley Company,
Milwaukee, Wis.

•

## *"New Style" Rural Line Built Five Years Ago*

*To the Editor of* ELECTRICAL WORLD:

With an ever-increasing number of companies turning to the use of common-neutral, long-span, low-class pole, crossarmless rural construction it should be of interest to see some information on the first common neutral rural line in the South, and, as far as is known, the first in the U.S. to combine all these features in rural construction. This line, on the Quitman Road south from Meridian, Miss., was built in 1931 by one of the power companies that has pioneered rural work in the South and was the forerunner of many miles of similar type line now being built by T.V.A., co-operatives and private companies.

For some time it had been desired to experiment with a cheaper type of rural construction, and an opportunity presented itself when the writer was requested to work out service to an area after estimates showed extension impossible under standard rural specifications. After considerable study, it was decided that savings could be made by

1. Using a common primary and secondary netural, grounding it at all available points.
2. Using as long spans as possible, increasing anchoring where necessary.
3. Using 35-ft. base poles of lower specifications than existing rural standards.
4. Using no crossarms except on transformer poles and secondary, deadending all wire on the pole.
5. Using one size conductor for all main line primary and secondary, stringing it to minimum sag.
6. Building the line as straight as possible, disregarding road location, eliminating all possible angle structures, yet staying within serving distance of all probable customers.

Structures were designed and field spotted so as to combine the above with low maintenance costs, continuous service and future expansion allowance. The line was built by a crew of "old heads" amid much kidding about the "skyhook line," "ground line" and other comments. Figures on the project were:

Voltage.....66.6 kv., phase to neutral
Length..... 5.2 miles, 19 customers
Poles.....35 ft., near class 6 ASA, ZMA treated pine
Conductor.. No. 2 ACSR, sagged 60% ult., light loading
Average span 436 feet
Future.....3 phase by adding crossarm and conductor

Unfortunately for the experiment, the depression made it impossible to keep accurate and impartial cost data on the project, and before another line could be laid out all construction work was abandoned. The economies were apparent, though, and the eventual influence of the line considerable, inasmuch as some of the engineers in the office at the time of design and construction have since been prominent in the design of rural specifications for the T.V.A. and several power companies. The line has given satisfactory service for five years now, and some extensions have been added.

E. A. BOWMAN,
Distribution Engineer, Roxie, Miss.

•

## *Alphabet Soup*

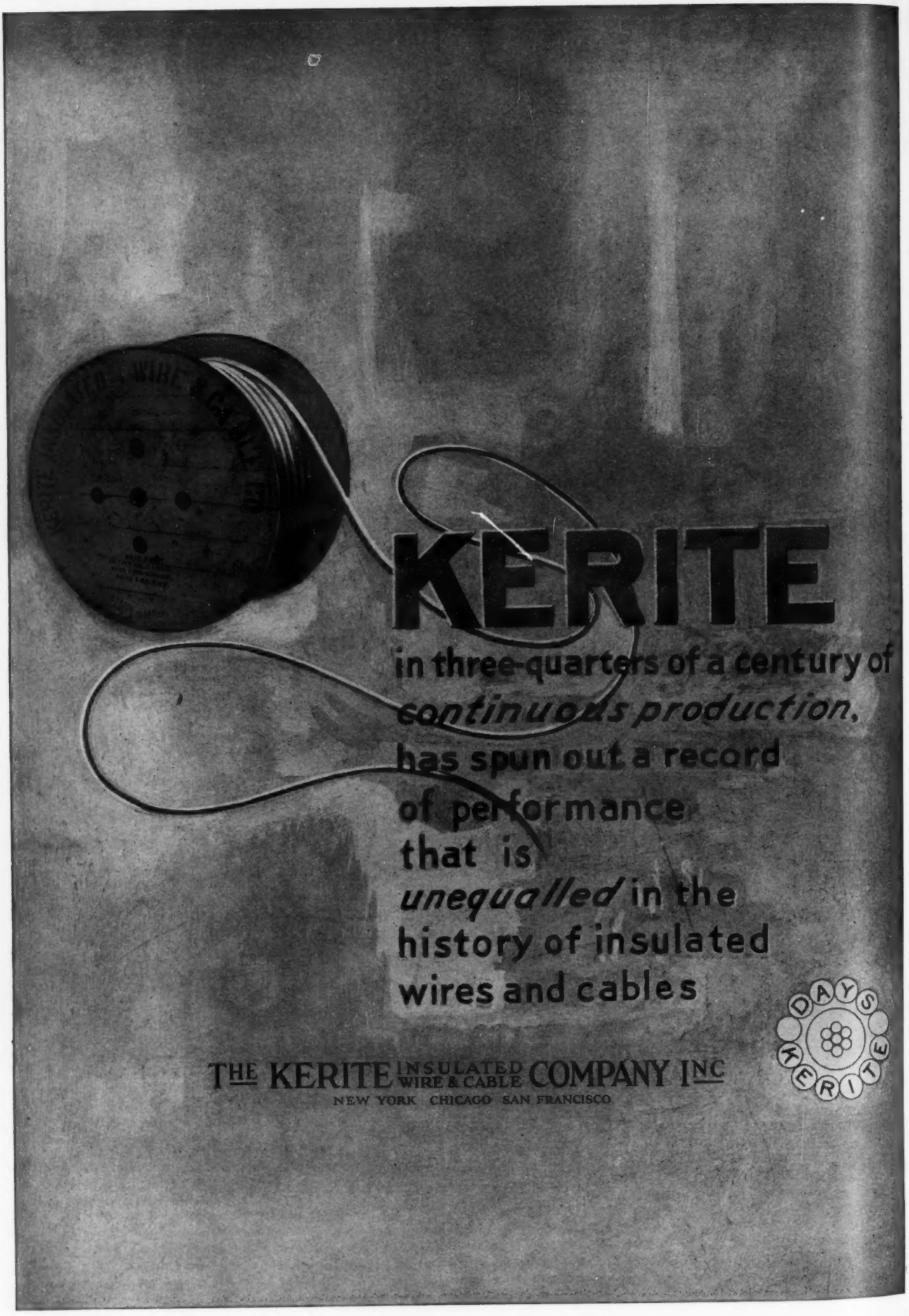
*To the Editor of* ELECTRICAL WORLD:

The writer would like to appeal to your editorial staff to insist that hieroglyphics be barred from your articles, so that a graduate electrical engineer with twenty years experience, naturally a specialist in some line, can have a chance at understanding the technicalities of an article in some other branch of the industry.

Particular exception is taken to "Simplify calculations of line factors" on page 90 of the ELECTRICAL WORLD of September 12, 1936.

AMI DUMM,
Readerville, U. S. A.

[As a long standing rule, we print no anonymous letters. But it takes exceptions to justify rules. So here you have one. In a strenuous effort to pack Mr. Ellsworth's material into snug space we used S.Y.P. and W.R.C. for Southern yellow pine and Western red cedar respectively. Were we dumb in assuming that 20-year graduates would guess the answer?—EDITORS.]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ELECTRICAL WORLD

NOVEMBER 21, 1936

# A Move Toward Constructive Regulation

Common comment is to the effect that the electrical industry is "over the hump" and that there is fairer weather ahead. Some of this is founded on the vague feeling that all the gloomy items have already been taken out of Pandora's box and there can be only hopeful ones left. But surer indexes than these can be pointed out from recent events. Thus last week the state regulatory commissions exhibited a more conservative temper than in any convention of the last six years. There were many new commissioners on hand, but far less disposition to rant and threaten drastic regulation than even two years ago, when there were fully as many new ones swept into office on a tide of social reform.

State regulation of utilities is fighting for its very existence against the absorption of all state regulatory powers by Washington. But instead of outdoing the federal boards in severity they are trying to undo the potentiality for centralization that the new federal legislation has fostered. Strangely enough, these very statutes were encouraged by the commission to offset their helplessness in dealing with interstate power matters and more recently with interstate motor carriers.

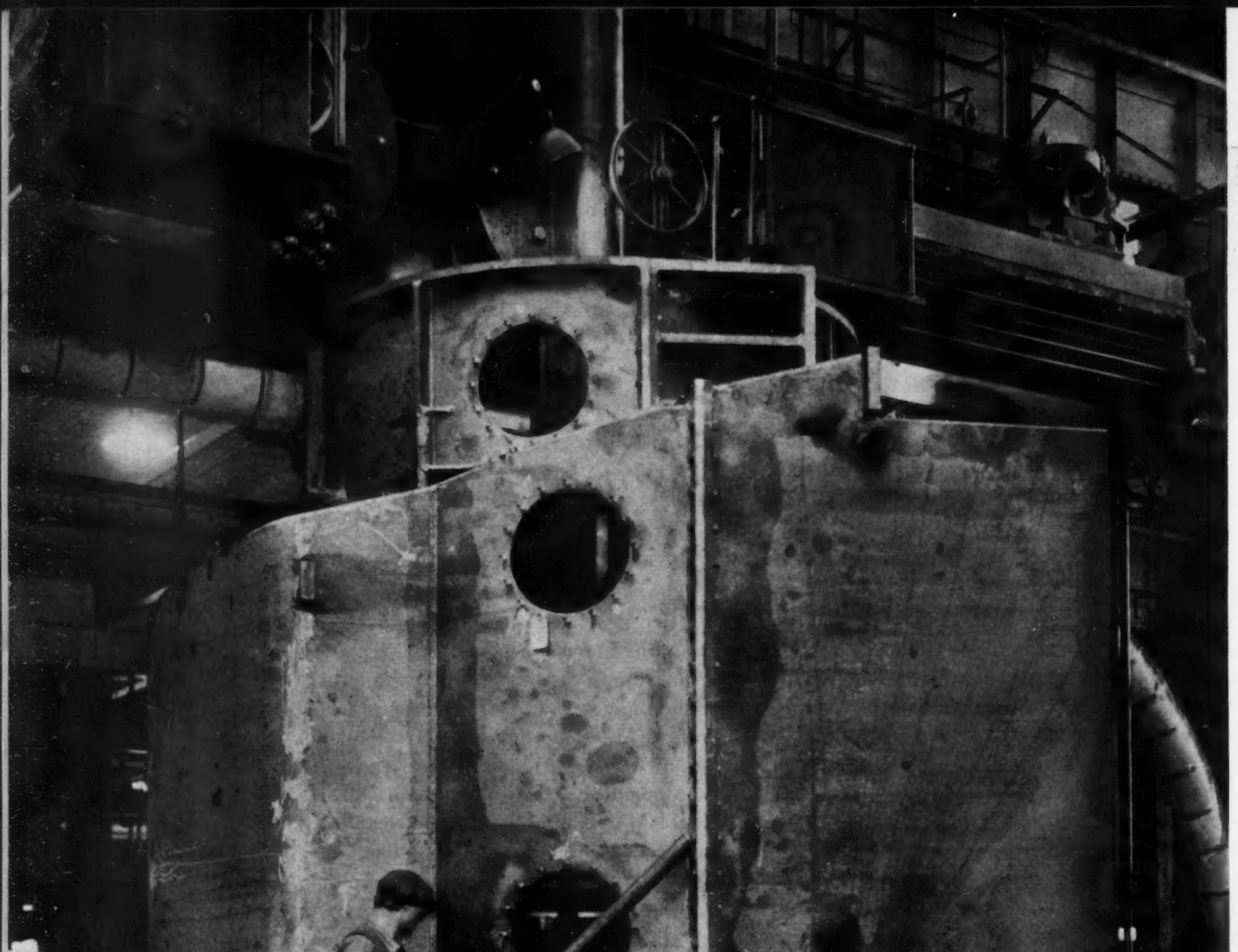
Commissions are finding themselves deeply entangled in trying to administer their local regulation of carriers and also to co-operate with the Interstate Commerce Commission in dealing with the interstate operator. It's a new, unblazed and intricate task. One commission finds it may be confronted by the need of participating in as many as 61 joint regional boards in order to regulate carriers that operate through the state. While struggling with this absorbing task the regulators are likely somewhat to "let sleeping dogs lie" as far as the electric utilities are concerned.

Another item—the Association promulgated a new uniform system of accounts and here again conservatism seized the foreground. The earlier proposals for rigorous depreciation accounting and for a perpetual inventory requirement disappeared from the final approved draft. Saner minds dominated because they see that rate reduction orders put the commissions in a most vulnerable judicial position if they are accompanied or followed by other orders which increase operating expenses. The word "boomerang" popped into the discussion.

Commissions are becoming, like their wards the utilities, load-building conscious. Their association committee on electric rates demonstrated that conclusively by their enumeration of the pros and cons for objective rates. A comprehensive survey brings out that no promotional rate is worth the paper it is printed on unless there is sales promotion geared to it. It is something to see commissions recognize that utilities have the problems of the peddler and are no longer in the "come-and-get-it" era.

In approving a fairly detailed plan of cooperation with the Federal Power Commission no doubt was left by the discussion that the state commissions will hold the federal board to the letter of the law and to the spirit of wholehearted conformity affirmed by the F.P.C. representatives. As a result, local matters, including retail rates, will stay as a state prerogative and only interstate accounting and interstate power interchange will be conceded to the F.P.C. The utilities are thus assured of whatever sympathetic treatment comes from an intimate appreciation of local problems.

Regulation by the state has been just one of the worries of the industry. But unless all signs fail it is headed for constructive, intelligent handling. The spirit of punishment is passing. In its wake is something more mutual, less arbitrary. Count that as a fairer weather gain.



## MOUNTING LOADS BRING MOUNTING ORDERS

**A typical scene in turbine shops these days as interest in turbine purchases returns. Here an arc-welded, fabricated exhaust hood for a 25,000-kw. steam turbine is being machined on a large boring mill. It is to be part of a G.E. tandem-compound turbine unit.**

# Standby Improved and Operating Costs Cut

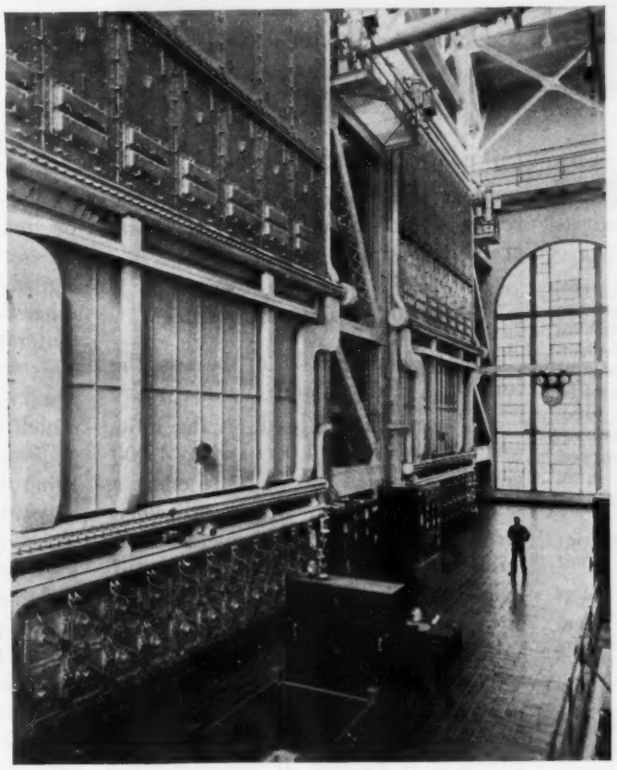
## Modified Combustion Control and Boiler Room Practice at Long Beach Station Permits Operation of 100,000-Kw. Units at 1 per Cent Load, Increases Stability and Reduces Full-Load Pick-Up Time by 62 per Cent

By J. R. ZEIGLER

Southern California Edison Company, Ltd., Long Beach, Calif.

GENERALLY speaking, reliability and economy are paramount considerations, but these factors involve many more which must be weighed and evaluated. In a system made up of hydro-electric and fuel burning plants some of these factors are the expected rainfall, probable storage on the watershed and in the reservoirs, present and future fuel costs and probable growth in load and in maximum demand. Having forecast these conditions from the best available data, the decision as to which type of plant to construct must be made.

After the plant has been built, and in spite of every precaution, some unforeseen events such as booms or depressions, a series of very wet or very dry years, or even the introduction of an entirely new source of power, may alter the original decision and require some changes in operating procedure.



**Boiler room, plant No. 3, Long Beach steam station of the Southern California Edison Company, Ltd.**
Three of these boilers normally supply the full load requirements of one 100,000-kw. turbo-generator.

Such a situation recently confronted the Southern California Edison Company, Ltd. Long Beach steam station of that company was designed and built to serve as a base load plant. From conditions encountered during the past few years it became increasingly evident that it is highly desirable to operate this plant as standby for emergency capacity during certain seasons of the year if the most stable and economical system operation was to be realized.

This change in its basic function indicated certain changes in equipment and methods of operation. Consequently a series of tests were run to determine how rapidly one of the 100,000-kw. units and its associated boilers in plant No. 3 could accept load from a minimum standby. As the tests progressed means for the improvement of the pick-up rate were devised.

The boilers that were used on these tests are Babcock & Wilcox cross-drum, straight-tube type with interdeck superheater, the furnace being completely inclosed by Bailey type water walls. Each boiler is provided with a tubular type air heater, two forced-draft fans, one induced-draft fan and a Bailey automatic combustion control. Other data are as follows:

*Boiler* — Boiler horsepower, 3,416; water to fill boiler, 200,000 lb.; normal evaporation from and at 212 deg. F. 3.45 lb. water/hr./sq.ft. heating surface; heating surface, 34,160 sq.ft.; total furnace volume, 19,800 cu.ft.; tube diameter, 4-in. O.D.

*Superheater* — Make, Babcock & Wilcox; type, convection, single pass, four loop, quadruple deck; surface, 6,588 sq.ft.; tube diameter 2-in. O.D.

*Air Heater*—Make, Babcock & Wilcox; type, tubular; external heating surface, 51,232 sq.ft.; internal heating surface, 46,350 sq.ft.; tubes, 2½-in. O.D.; number of tubes, 2,176.

*Burners*—Make, Peabody Engineering Corporation; number, 20 per boiler; type, Peabody-Fisher wide range mechanical oil

**Fig. 2—Generating room of plant No. 3 showing the two 100,000-kw. units**

Originally designed for base-load service, these units have been adapted to part-time emergency standby, operating at 1 per cent load with a rapid load acceptance characteristic.

and three-piece natural gas burners; maximum capacity, 20 burners with natural gas at 425 per cent boiler rating, 585,000 cu.ft. per hour; natural gas pressure at burners approximately 5 lb. per sq. in.

*Turbine*—Make, General Electric; type, Curtis, horizontal, two cylinder, tandem compound double flow in low-pressure cylinder; speed, 1,500 r.p.m.; normal throttle pressure, 415 lb. per sq. in. absolute; normal temperature of steam at throttle, 750 deg. F.; exhaust pressure 1.5 in. absolute; number of stages in high-pressure cylinder, 18; number of stages in low-pressure cylinder, 3; extraction points, fifth, tenth, fourteenth and eighteenth stages.

*Generator*—Make, General Electric; capacity, 90,000 kw. at 90 per cent power factor.

*Auxiliary Shaft Generator*—Make, General Electric; capacity, 4,000 kw. at 80 per cent power factor.

### *Loads rapidly taken*

Three boilers are sufficient to carry full load of 100,000 kw. on one of these turbines and it had been standard practice to have only three boilers on the line when operating at standby. Five tests were made with this set-up without any changes in the equipment or methods of operation. From a minimum net load of 4,000 kw. the main generator was suddenly loaded to 25,000 kw., 50,000 kw., 75,000 kw., and to a load corresponding to full valve opening. A similar test was run starting at 25,000 kw. net load on the main generator and suddenly loading it to 80,000 kw. The results of the first four of these tests are shown in Fig. 3.

### *Minimum load setting reduced*

After the completion of the tests the following changes were made:

1. Minimum net load on the units was reduced from 4,000 kw. to 1,000 kw. This change was made to effect a saving in fuel costs. In general, when these units are being operated at minimum load there is an excess of hydro capacity on the system. Hence any lowering of the net load will result in a direct saving of the fuel differential between the two loads. It is interesting to note that this operation is at 1 per cent of maximum load, which, it is thought, is unprecedented in machines of this size. This operation has been uniformly satisfactory, with no trouble of any sort having been experienced due to this unusual loading.

2. A low steam-pressure alarm was installed in the boiler room. This alarm is set to go off at 12 lb. below the normal header pressure of 420 lb./sq. in. gage in the steam receiver. A minimum of delay in starting fuel to the boiler is imperative if the best capacity is to be obtained from the equipment. Hence a prompt and reliable means of notifying the boiler room of an emergency is necessary.

3. The Bailey combustion control drive was speeded up. In order to accept rapid increases of load it was found necessary to put all the fuel possible into the boilers in the shortest practical time. This meant that the fuel valves, the fans and the dampers had to be opened with a minimum of delay. To accomplish this it was necessary to make the following changes in the Bailey control drive and in the fuel valves:

### *Combustion control speeded up*

The Bailey combustion control originally was equipped with a double set of clutches. One set was designed for normal operation and the other set for quick return of the fan motor brushes to the starting position. This second mechanism operates at four times the speed of the normal clutch and, for the purposes of emergency operation, has been adapted to bring the fan motor brushes to the maximum speed position. Further to shorten the time required to reach maximum fan speed the minimum position on the Bailey control drives was moved up to 25 per cent on the induced-draft fans and 15 per cent on the forced-draft fans. These settings allow the induced-draft fan to lead the forced-draft fan on the high-speed setting.

---

*Few problems require greater skill and judgment than the selection of new plant facilities for the modern electric utility. System characteristics change and steam plant additions to generating capacity involve the initial decision as to whether a base load, peak load or a plant adapted to both services best will meet future as well as present requirements. "Cal Edison" found an optimum solution for the Long Beach station*

---

Because the fuel control drive mechanism has no quick return gearing its speed of operation could not be conveniently increased. However, the mechanical intermittent travel limit cam on the fuel drive was removed, making it no longer necessary for the fireman to release intermittently and reclose the fuel drive circuit. Push-button stations at each boiler control board allow the fireman to select high-speed operation for emergency quick pick-up when the station is on standby operation or return the circuit to normal for ordinary regulation by the Bailey control system.

When the boiler is in the emergency position the fireman starts the fans, partially opens the fuel valve and places the Bailey control switch in the completely automatic position. The balance of the "bring-up" is entirely mechanical and requires 24 seconds from the time this position is reached. Under test conditions all the boilers reached maximum fan speed and maximum fuel flow in approximately 45 seconds.

4. Calculations showed that considerable heat left the turbine during the first two minutes to heat the feedwater in the heaters, piping, etc. It was reasoned that if this heating could be delayed for a few minutes the same heat could be used for generating power and the feedwater could be heated later after more steam was available from the boilers. Therefore, in an attempt to obtain greater load during the initial phase of the pick-up period the extraction valves were throttled down until the gates were within ¾ in. of the bottom of the seats. During this test more load was picked up in the first half minute, but it was soon lost and not readily increased afterward. The reason for this unfavorable result was readily explained by examination of the back pressure throughout the test. This operation was virtually non-extraction and the sudden rush of steam to the condensers lowered the vacuum to the point where the increase of back pressure more than overweighted the gains due to delayed feedwater heating.

### *Water level established*

5. The amount of load that can be carried on the turbine is definitely limited by the steam pressure available. Consequently the maximum number of kw. which can be accepted and carried throughout a system disturbance is restricted by the minimum steam pressure experienced. The time and method of adding feedwater during a quick pick-up is of vital importance in obtaining the highest possible minimum steam pressure. Addition of a large amount of relatively cold feedwater to the boiler at or near the time of lowest pressure will materially lengthen the period of recovery and may endanger the successful retention of the full load picked up. In these tests it was found advisable to keep the water level at about 5 in. on the gage when on standby so that the addition of water would not be immediately required. A momentary swell to about 15 in. was experienced. The increased flow of steam from the boiler soon lowered this level and no carryover was experienced.

6. Four boilers are now carried on the line with one unit at minimum load. The approximate steaming characteristics of one of these boilers is shown in Fig. 4.

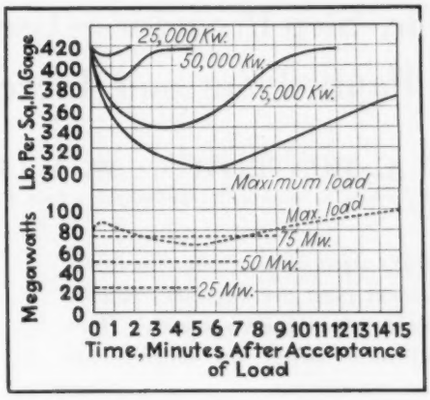



**Fig. 3—Pressure recovery and load acceptance curves before changes were made in the combustion control**

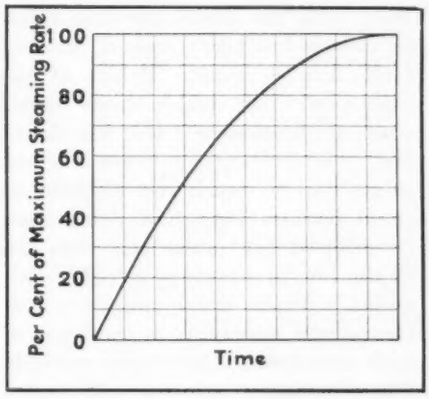



**Fig. 4—Pick-up rate of plant No. 3 boilers**

To obtain last 25 per cent of capacity requires the same time as to reach 75 per cent capacity.

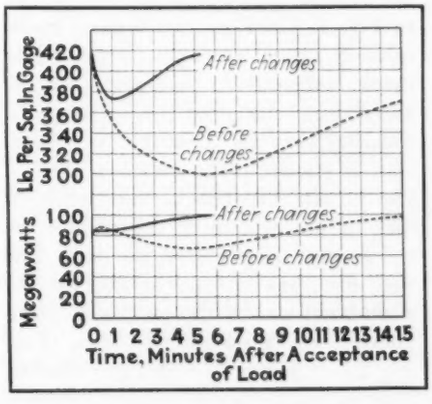



**Fig. 5—Improvement in pressure and load acceptance curves is very marked after a few simple changes were made in the boiler and combustion control equipment**

Most important is the reduction in time necessary to reach full capacity from 1 per cent.

### *Steaming up time halved*

Observation shows that it takes practically twice as long for one of these boilers to reach maximum capacity as it does to reach 75 per cent of maximum capacity. Consequently by operating four boilers instead of three it was possible to reach a given steaming rate in approximately half the time formerly required. The small additional cost of operating this boiler is more than justified by the desirable stability and quicker pick-up obtained from its operation.

After making these changes another series of tests was made with results as shown on Fig. 5. This graph shows the performance of the equipment under similar conditions before and after making changes in operating methods and equipment. A comparison of these results is clearly shown in the following tabulation:

| | Before | After |
|---|---|---|
| 1. Minimum steam pressure, lbs. | 300 | 372 |
| 2. Load before test, kw. | 4,000 | 1,000 |
| 3. Minimum load during test, kw. | 68,000 | 84,000 |
| 4. Time to reach 100 MW, minutes | 16 | 5 |

Result No. 1 indicates much improved stability. Result No. 2 indicates decreased operating costs while on standby. Result No. 3 shows a 23.5 per cent increase in load which can be accepted and held. Result No. 4 indicates a reduction in time to reach full load of 62.5 per cent.

These improvements were obtained with a very small expenditure, which has already been more than paid for in reduced operating costs. The standby reserve characteristics of this plant are now considered superior to those of many stations designed for such service.

# Planned Protective System

## To Care for Load Growth Modernize Breakers and Relays—Step-by-Step Program—Use of Carrier Relays Reduces Fault Time and Increases Capacity

By A. C. MONTEITH . . . W. A. LEWIS
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

*Speeding up of breakers and relays with or without the introduction of carrier raises the question how the advances can be incorporated smoothly, economically and advantageously. Here is timely advice from Westinghouse based on nation-wide participation in the rehabilitation movement.*

THE rapidly increasing load on power systems forcibly directs the attention of utility engineers to some means of increasing transmission capacity. There have been a large number of developments in relay systems and in circuit breakers since the peak loads of 1929 and 1930 and the incorporation of these improvements in systems designed prior to this period will provide important increases in transmission capacity. These improvements in general consist of speeding up the operation of oil circuit breakers from approximately 24 cycles to 8 cycles or less, on the basis of 60-cycle system frequency, and the introduction of high-speed relay systems which make possible relay tripping times approaching one cycle for favorable fault locations. Superimposing of carrier current on this line of relays has made rapid fault clearing possible for faults in all locations. This discussion suggests an orderly program in which the benefits of these developments can be applied to existing systems.

### *How to make changes*

Changes which can be made to existing oil circuit breakers consist of the addition of modern arc-rupturing devices, such as "Deion" grids, to the contacts and the speeding up of the operating mechanism. Previous to the introduction of the high-speed line of relays induction type relays were used almost exclusively. These took the form of overcurrent, balanced current or impedance relays and depended largely on time for proper discrimination. The combination of these with the slower clearing times of circuit breakers resulted in long fault clearing times. Relays of the high-speed line which have found wide application are the impedance and balanced current types. These relays fail to reach the ultimate in speed because some time delay must be allowed for faults near the end of the line to secure proper discrimination. Recent developments in carrier-current apparatus in combination with impedance relays make possible the elimination of time delay for faults near the end of the line.

Improvements in circuit clearing time which can be obtained by successive steps in a program of protective system modernization are shown in Fig. 1. In Fig. 1a a typical transmission system is shown, divided into three transmission sections. In the succeeding parts of the figure the clearing time for a fault in any location is shown. The clearing time of the circuit breaker at the left-hand end of the section is represented by horizontal lines above the base line and the time of the breaker at the right-hand end of the section by horizontal lines below the base line. Taking 24 cycles as the average clearing time of conventional circuit breakers, the maximum fault clearing time for a three-section line with conventional definite-time overcurrent relays becomes approximately 120 cycles, as shown in case 1. The corresponding fault clearing times for successive steps in modernization are shown in the succeeding parts of the figure.

It is assumed, first, that the definite-time relays are replaced by high-speed impedance relays, giving the results of case 2. The next step is the modernization of the circuit breakers to obtain 8-cycle operation, giving the results of case 3, with corresponding reduction in the time intervals necessary to secure proper discrimination. The last step is the superimposing of carrier current on the high-speed relays in order to secure the most rapid time of fault clearing throughout the entire circuit. Where the original relay protection is of the balanced-current type it may be advantageous to modernize the circuit breakers before the relays are changed to the high-speed type. Where graded time relaying is used, however, it will usually be found that the same improvements can be obtained for less expenditure by modernizing the relay system as the first step. Where a detailed study shows that it will never be necessary to go to the clearing times of case 4, consideration can be given to high-speed balanced-current relays in place of the high-speed impedance relays used in case 1.

### *When to make changes*

The question naturally arises as to when the successive changes should be made and what benefits can be obtained from each. The answers to these questions are indicated in the curves of Fig. 2, which show the load that can be carried during a fault of the type indicated, without loss of synchronism, for different values of fault clearing time. The generally accepted practice at present is to design a system to withstand a two-line-to-ground fault without loss of synchronism, it being assumed that this

type of fault is the most severe for which it is economically feasible to provide.

A three-phase fault is of course more severe, but the small probability of its occurrence and the expense of designing the system to withstand it usually makes it impractical to consider this type of fault as a basis of system design. Two sets of curves are shown, for the typical system of Fig. 1, in which all of the power generated is transmitted to the receiving end. One set of curves is for hydro-driven generators, with their corresponding high reactance and relatively low stored energy. The second set of curves is for steam-driven generators. In each case curves are drawn for a fault at the worst location, corresponding to *X* in Fig. 1 and with zero fault resistance.

In many cases in actual practice some of the load is directly adjacent to the generators and all of the generator output is not transmitted to the receiving system. This shunt load will make the system more stable for the same amount of power transmitted and will result in the same trend in improvement, as may be observed by comparing the curves for steam generators with those for hydro generators. In other words, steam-driven generators show an improvement over hydro-driven generators, and either hydro or steam systems with shunt loads at the generating end will show an improvement over the same type of system in which the entire generator output is transmitted to the receiving end. Faults at other locations than the one shown will be less severe and will permit longer clearing times. Similarly, resistance in the ground return path will have the same effect as a shunt load and the same tendency toward increasing the permissible fault duration.

Curves are shown for both two-line-to-ground and single-line-to-ground faults, as a basis of comparison. In every case it can be seen that the permissible time of clearing for a single-line-to-ground fault without fault resistance is much greater than the time permitted for a two-line-to-ground fault at the same location and with the same amount of power transmitted. Since, in general, the two-line-to-ground faults are cleared by the phase protection and the single faults by the ground protection, it is evident that much slower ground-fault clearing can be permitted without endangering system stability. A study of these curves in conjunction with the cases of Fig. 1 will show that in general no change will be required in the ground relays until the final step is taken of adding carrier current to the relay system.

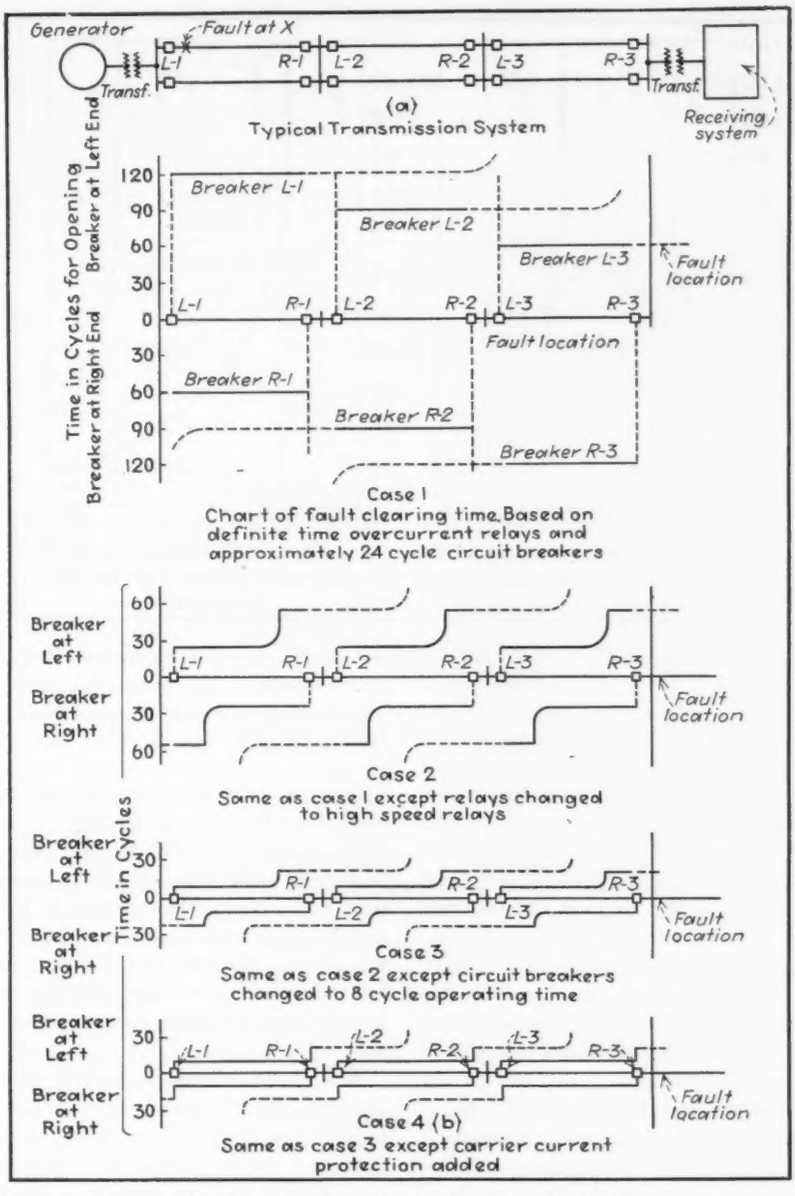



**Fig. 1—Charts showing speed of fault clearing obtainable by successive steps of protective system modernization**

The modern carrier-current system, such as used in case 4, includes high-speed ground fault protection as well as high-speed phase-fault protection. It is, of course, to be understood that other reasons, such as the spreading of single faults to other phases or the reduction in duration of voltage dips, may suggest the earlier use of high-speed ground relays, but usually this change will not prove necessary from the standpoint of maintaining stability alone.

The following example indicates the relative improvement that will be obtained by the successive steps in the modernization program. The clearing time for the worst fault location in case 1 is 120 cycles. This value, referred to the dotted curve of Fig. 2 for sequential tripping, indicates a permissible load of 30 per cent for the two-line-to-ground fault with hydro generators and 38 per cent load with steam generators. For the same time of single-line-to-ground fault clearing the figures are 87 and 124 per cent respectively. Changing the relays to the high-speed type, as in case 2, results in a maximum clearing time of 56 cycles and indicates that 39 per cent load could be carried on the hydro system and 66 per cent

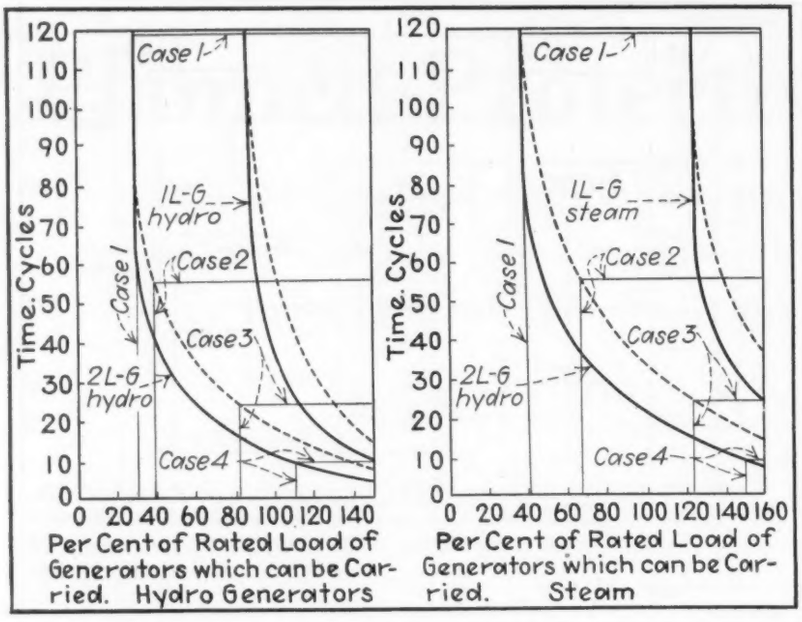

Time. Cycles
Case 1
1L-G hydro
Case 2
Case 3
2L-G hydro
Case 4
Per Cent of Rated Load of Generators which can be Carried. Hydro Generators
1L-G steam
Per Cent of Rated Load of Generators which can be Carried. Steam

**Fig. 2—Load which can be carried through the type of fault indicated without loss of synchronism**

Solid line—Breakers at both ends opening simultaneously. Dotted line—Breakers opening sequentially. The breaker nearest the fault opening first.

on the steam system. Assuming no change in the ground relays, it is seen that the 87 and 124 per cent respectively of the single-ground fault are still greater than the loads that can be carried for the two-line-to-ground fault. The change to high-speed impedance relays shows an improvement in the amount of load that can be carried of from 30 to 70 per cent.

Clearing time for the worst type of fault shown in case 3 is approximately 26 cycles for the phase relays, and this will allow carrying 80 per cent load for the hydro system and 122 per cent load for the steam system. These values are still below the values obtained with the original ground relays of case 1. The change to high-speed relays and modernized breakers allows an increase of 167 per cent for the hydro system and 222 per cent for the steam system, as compared to case 1.

The clearing time in case 4 of approximately 10 cycles for the worst location of fault shows that 110 per cent load can be carried for the hydro system and 148 per cent load for the steam system with simultaneous tripping. By comparison with the loads that can be carried with the ground relays of case 1, it is seen that changes now have to be made in the ground relay system. The changes of case 4 indicate an increase of 267 per cent for the hydro system and 290 per cent for the steam system, as compared with case 1.

If the fault is in the middle portion of any section the system will be more stable in all cases due to the fact that the fault is in a more favorable location, and there will be an additional improvement in cases 2 and 3 due to the fact that simultaneous tripping will be obtained at both ends of any section. The curves of Fig. 2 are drawn for the fault in the worst location so that the load that can be carried for the fault in the middle portion of the line will be at least as good as the solid curve for simultaneous tripping. The above results indicate that where practically all the generated power is transmitted to the receiving end immediate consideration should be given to high-speed breakers and high-speed relays if the best operation is to be obtained from the system.

It must of course be borne in mind that the curves of Fig. 2 are typical and should be used only to indicate trends. When for a specific system accurate results become necessary an individual system study should be made. Modern methods and improved facilities expedite the securing of accurate results on even the most complicated systems.

## FARM HOMES 20 PER CENT SERVED

Nearly 20 per cent of the farms in the United States are now receiving electric service, if those farms are excluded that have dwellings valued at less than $500, and are therefore poor prospects for electrification. This contrasts with the much lower ratio usually quoted, which involves the inclusion of farms without dwellings or with dwellings of very small value, but it obviously gives a better measure of what has been achieved.

According to the farm census for 1935, the number of farms having occupied dwellings was 6,482,227, while those having dwellings valued at more than $500 total only 4,388,231.

These figures are quoted in a recent compilation by the Edison Electric Institute, which gives the number of farms having electric service as of June 30, 1936, as 860,038. The latter is 13.3 per cent of the total, but it is 19.6 per cent of the number having dwellings worth $500 or more. The accompanying table is abstracted from the one published by the institute, which gives detailed statistics by states.

### Farm Electrification

June 30, 1936

| Region | Farms with Electric Service | Per cent Electrification (A)* | (B)* |
|---|---|---|---|
| United States | 860,038 | 13.3 | 19.6 |
| New England | 74,847 | 49.4 | 52.3 |
| Mid. Atlantic | 131,436 | 33.9 | 35.4 |
| E. No. Central | 217,766 | 20.7 | 22.7 |
| W. No. Central | 97,239 | 8.6 | 9.9 |
| So. Atlantic | 66,601 | 6.2 | 11.2 |
| E. So. Central | 38,382 | 3.6 | 9.0 |
| W. So. Central | 27,555 | 2.6 | 5.4 |
| Mountain | 54,100 | 21.2 | 31.4 |
| Pacific | 152,112 | 54.6 | 65.9 |

* Column A compared with all farms having dwellings.
Column B compared with farms having dwellings valued at $500 or more.

Customer data have been revised to take into consideration the reclassification of several states to adjust for differences in the 1935 census of farms and company records. The revision transfers 30,300 customers from "residential" to "farm," compared with earlier listings.

California leads with 80.1 per cent of electrification of the $500 group and 68.1 per cent of all with dwellings; North Dakota has 3.1 and 2.6 per cent, respectively, and Mississippi has 4.3 and 1.2 per cent. Much greater progress has been made on the Pacific Coast and in the New England States than in the remaining geographical regions.

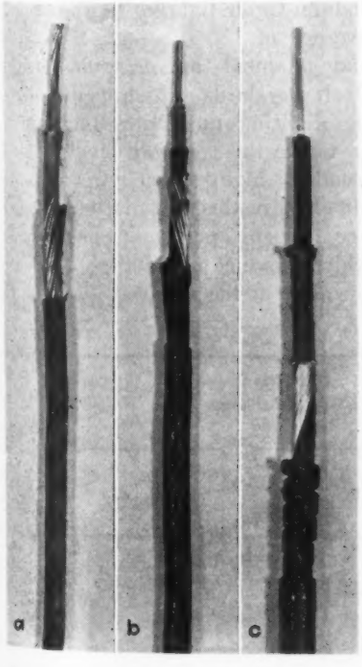
# 46 Years With Bare Neutral

## Masonic Temple Building in Buffalo Wired With Two-Conductor Bare Neutral Concentric Cable in 1890 — Results of Observations

**By E. A. BRAND**

Commercial Engineer Niagara Hudson Power Corporation

AN INTERESTING and historical wiring installation was recently uncovered in Buffalo when it was found that the Masonic Temple Building, 43 Niagara Street, was wired with two-conductor bare neutral concentric cable. The discovery was made by Edward Small, safety engineer for the Buffalo, Niagara & Eastern Power Corporation, who, while reading a magazine description of modern bare neutral wiring, recalled that twenty years ago, as a wireman, he had made changes in a building completely wired with material that greatly resembled concentric cable. An examination was made and it was found that two floors of the building were still being served with the original circuits, which were indeed a forerunner of the modern LCX and CNX cables.




**Old and new bare neutral cable**
(a) Cable from 1890 Masonic Temple. (b and c) Modern designs of bare neutral.

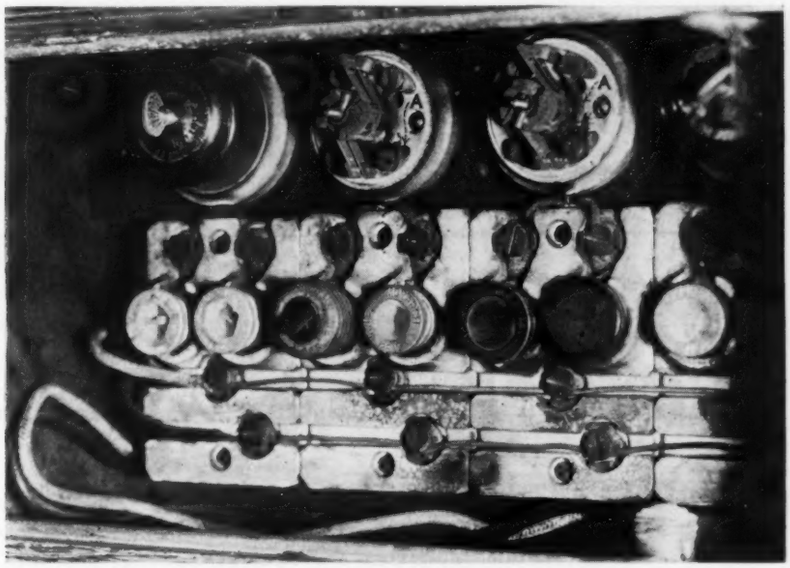
The Masonic Temple Building was erected in 1890-91, and while the original building plans are available, no electrical specifications could be found. The lighting outlets were indicated on the plans by crosses (X), but no circuit runs, panels or other features of the wiring system were shown, as is common in modern plans. However, a perusal of other available records indicates that the entire installation was made by the Edison General Electric Company. The building naturally was served by a private plant, and the Edison G. E. Company work included the engine, generator, all wiring, fixtures and lamp bulbs. Originally the plant apparently operated at 50 volts.

In 1919 the private plant was supplanted by Edison d.c. service at 110/220 volts, supplied by the Buffalo General Electric Company. In 1932 service to the building was changed from direct current to 60-cycle, three-phase, four-wire, 120/208-volt alternating current.

**Masonic Temple erected in 1890-1891**

The Masonic Temple Building is a brick and steel framed structure containing basement, seven floors and an attic, with the usual lodge halls, meeting rooms and banquet hall, in addi-

[*Continued on page* 98]



**Fuse cutout cabinet installed in 1891 is in active use. Switches are rated ten lights and bare neutral circuits are shown**

# Lighting

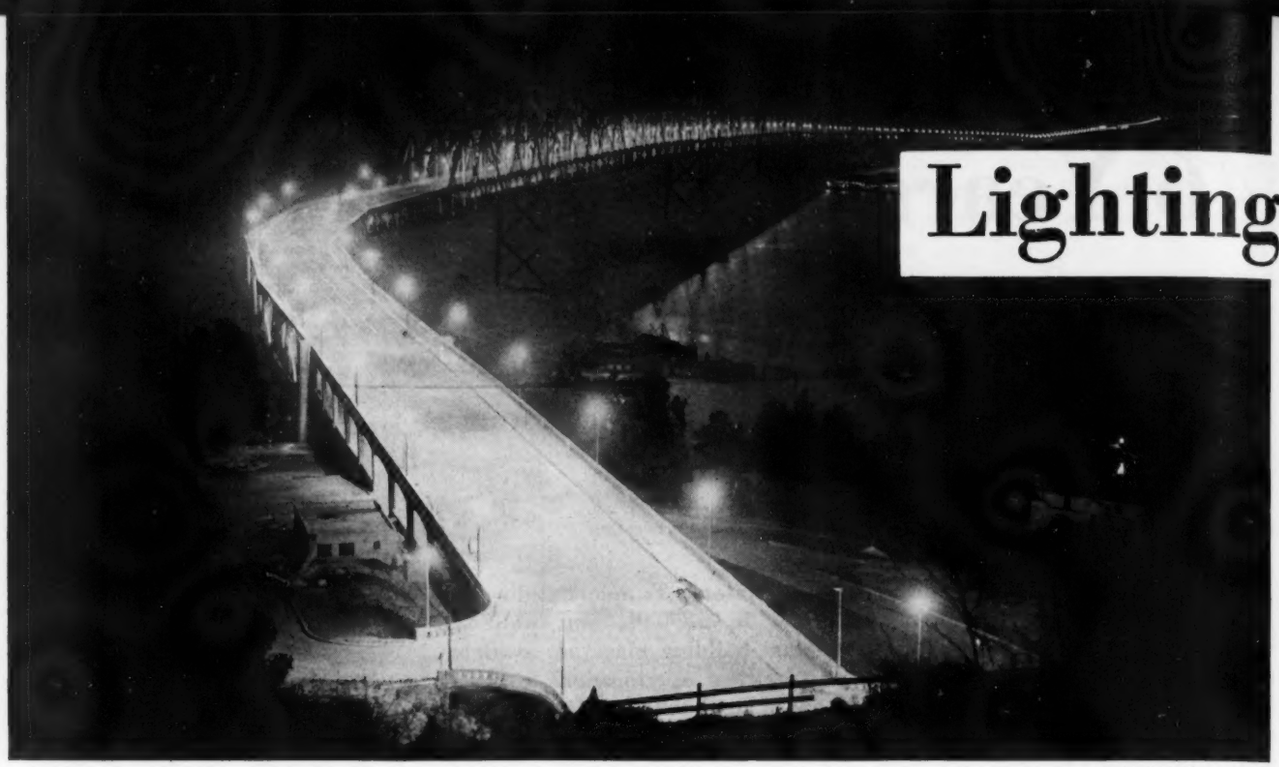


*Photo by Gabriel Moulin*

**Sodium-vapor units selected for the roadway illumination on the 95-mile, double-deck bridge between San Francisco and Oakland—Centralized control, sectionalized distribution and high-intensity lighting features of $520,000 lighting installation**

SAN FRANCISCO and Oakland have been joined by a new highway link provided by the completion of the huge 9.5-mile bridge across San Francisco Bay. Bridging the bay was an outstanding engineering achievement involving construction of two tandem suspension spans joining San Francisco and Yerba Buena, the island in the middle of the bay, a tunnel through the island, eight cantilever spans and eighteen spans of truss construction which terminate in a "cloverleaf" system of approaches on the Oakland side of the bridge. The total length of the structure is as follows:

| | Feet |
|---|---|
| Two west channel suspension spans | 10,587 |
| Yerba Buena tunnel and cuts | 1,667 |
| Eight east channel spans including 1,400-ft. cantilever span | 5,018 |
| Eighteen trussed construction spans | 5,226 |
| San Francisco and Oakland mole approaches | 13,908 |
| Oakland shoreline distribution (cloverleaf) | 13,580 |
| Total length of bridge and approaches | 49,986 |

On the upper deck of the bridge space is provided for six high-speed traffic lanes. On the lower deck three lanes of heavy truck traffic and two electric interurban railway tracks will be carried. Including the double-deck portion, the total length of roadway is 13.7 miles.

Safety was a paramount consideration in the design of the lighting installation. Because the bridge is expected to carry extremely heavy traffic during the day and evening, adequate illumination was considered essential to expedite the flow of night traffic as well as to minimize the hazard of night driving.

The lighting installation may be divided into three main divisions, the bridge proper, the approaches and the administration building and toll plaza located 6,100 ft. from the eastern end of the bridge on the Oakland mole. For the bridge proper the upper, or six-lane, high-speed traffic roadway will be lighted by 10,000-lumen General Electric sodium-vapor lighting units spaced an average of 150 ft. apart, set opposite and mounted on octagonal tapered steel standards which will support the lighting units approximately 25 ft. above the roadway level. An unusually high efficiency has been obtained in this installation, the average lumens per foot being 133.3, which produce an average foot-candle intensity at the roadway of 0.84 foot-

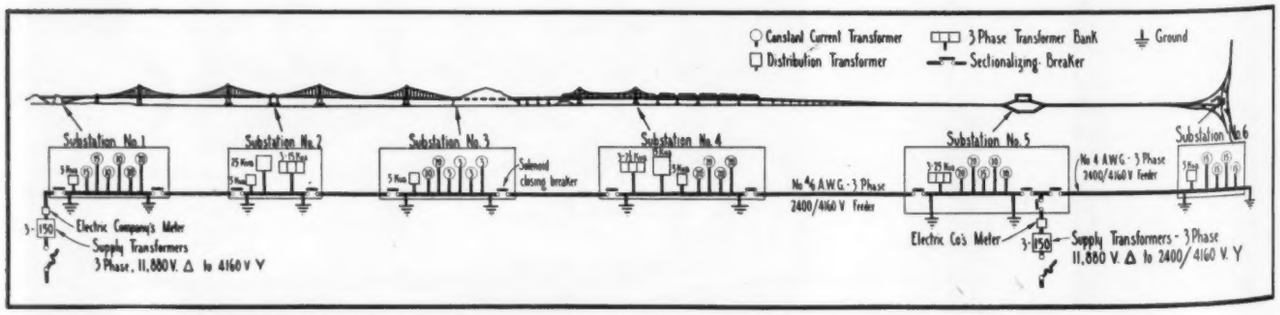

Constant Current Transformer
Distribution Transformer
3 Phase Transformer Bank
Sectionalizing Breaker
Ground
Substation No. 1
Substation No. 2
Substation No. 3
Substation No. 4
Substation No. 5
Substation No. 6
Solenoid closing breaker
No 4/0 A.W.G. - 3 Phase 2400/4160 V Feeder
No 4 A.W.G. - 3 Phase 2400/4160 V Feeder
Electric Company's Meter
Supply Transformers 3 Phase, 11,880 V. Δ to 4160 V Y
Electric Co's Meter
Supply Transformers - 3 Phase 11,880 V. Δ to 2400/4160 V. Y

**Fig. 1 — Six distribution substations for roadway lighting, aviation, navigation and fog signal equipment**

The one main feeder is nominally sectionalized at substation No. 3 the west end of the bridge being fed from San Francisco substation and on the east end from Oakland substation to that point. In case a fault occurs between any of the substations the nominally opened sectionalized breaker in substation 3 is closed and the faulty section isolated by the substation breakers on either side.

# the World's Longest Bridge

By **WILLIAM P. BEAR**
Illuminating Engineer
Pacific Gas & Electric Company,
San Francisco

candle. The open-type reflector in combination with the low surface brightness of the light source contribute to this end.

On the lower deck the three lanes of heavy truck traffic will be illuminated by a single row of 10,000-lumen sodium-vapor units installed approximately 120 ft. apart and supported on steel brackets attached to the under side of the beam girder supporting the upper roadway. Lighting of both the upper and lower roadways in the Yerba Buena tunnel will be similar to that used throughout the length of the main structures with the exception that the lighting units for the upper deck will be supported on brackets set into the concrete lining of the tunnel.

For the approaches the Fifth Street plaza on the San Francisco side will be lighted by sixteen 10,000-lumen Mazda units supported on steel standards giving a 20-ft. height to the light center. On the Oakland mole between the end of the bridge and the toll plaza there will be installed a total of 44 double sodium-vapor units set in two rows between the roadway lanes. The toll plaza itself will be lighted by fourteen 15,000-lumen Mazda units at a 25-ft. mounting height. Between the plaza and the cloverleaf the roadway will be lighted by 29 double sodium-vapor units mounted in a single row between the roadway lanes. The cloverleaf itself will be lighted by a total of 132 10,000-lumen sodium units mounted on steel standards at a height of 24 ft. 6 in.

Circuits for all roadway lighting will be 6.6-amp. series alternating current with individual series transformers for each lamp. Transformers for the sodium-vapor lamps will be of a 1 to 1 ratio or 6.6 amp. and for the Mazda units will be 6.6/20 amp. Aviation, navigation and fog signals will be served from 120/240-volt, three-wire multiple circuits. The total number of units used on the bridge structure and approaches will be 922 sodium-vapor units and 35 Mazda luminaires.

**Sodium-vapor lighting units suspended from roof of tunnel**
Upper deck roadway through the tunnel through Yerba Buena Island connecting the two tandem suspension spans on the west end with the eastern section of the bridge.

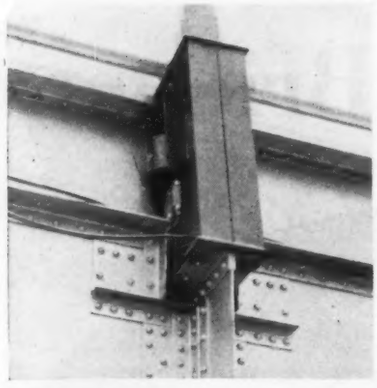
**Double luminaire standard mounts two 10,000-lumen sodium-vapor lighting units**

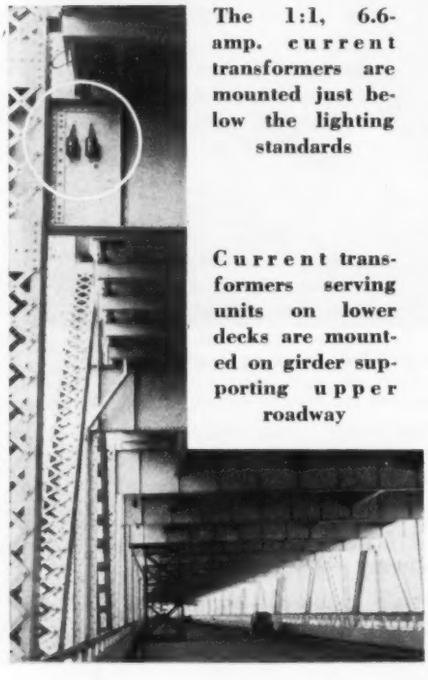
**Sodium-vapor lighting standard used on upper deck of Oakland approach**

*Courtesy California Toll Bridge Authority*

Due to corrosive salt air conditions, all cable used on the bridge and approaches is provided with a bronze armor over the rubber insulation. Where cables are laid on bridge members the bronze armor is left as the outer covering. Where cables are buried in the sand along the approaches a double layer jute covering is added over the bronze armor to avoid soil corrosion.

Electric service for the lighting of the project will be supplied through 11,880/2,400-volt substations located





**The 1:1, 6.6-amp. current transformers are mounted just below the lighting standards**

**Current transformers serving units on lower decks are mounted on girder supporting upper roadway**

at either end of the project. Only one main feeder is laid across the bridge, the feeder being 2,400/4,160 volts, three phase, four wire. This feeder will be sectionalized at either side of each of six distribution substations located at approximately equal intervals along the structure. These circuit breakers are both electrically and mechanically interlocked to prevent synchronizing of the power company networks on either side of the bay. These substations control all of the roadway lighting, including the lighting for aviation, navigation, fog signals and illuminated traffic signs.

The total connected load for the entire project is as follows:

| | |
|---|---|
| 18 distribution transformers, kva. . | 210.5 |
| 25 constant-current transformers for series lighting, kva. . . . . | 357 |
| Total connected load of lighting and power, approximately, kw. . | 370 |
| Estimated maximum demand, kw. . | 285 |
| Annual kilowatt-hour consumption, kw.-hr. . . . . | 1,181,932 |
| Approximate monthly consumption, kw.-hr. . . . . | 98,500 |

Transformer banks for the two main sources of supply will each consist of three 150-kva., single-phase transformers delta connected on the primary side and star connected on the secondary side. All sectionalizing switches at substations, all lighting circuits for roadways on the upper and lower decks, all lighting for aviation, navigation and fog signals and all substation equipment will be controlled from one switchboard located at substation No. 5 in the administration building at the toll plaza. Indicating signals will be arranged to show the position of all switches and circuits involved in the entire bridge project.

### *Light for aviators and navigators*

Lighting for aviation will consist of six 1,000-watt single-lens rotary beacons, one of each to be mounted on the top of the four high towers of the west bay suspension and the two towers of the east bay main cantilever span. Five 400-watt flashing beacons also will be mounted on the tops of the five long truss spans in the east bay channel. Rotary beacons will be synchronized in two separate groups so that the beams of each group will parallel. Flashing beacons will be operated by a flasher mechanism and a character wheel which will energize them on a predetermined schedule.

Navigation lighting will consist of the usual red, white and green Fresnel lens units and red and white pier lights. Fog signals will consist of five large bells, stroked by means of electric thrustors. In addition there will be six 10-hp., motor-driven fog sirens operated by two motor-driven synchronized coders.

Because of the unusual length of the structure a complete telephone communication system is installed for bridge operation. This consists of a total of 22 police phones, six substation telephones, 58 plug-in stations, six portable telephone sets, eleven open transmitters and a sixteen-station central telephone call board, together with two central station telephones and 22 100-watt police call lamps located along the structure.

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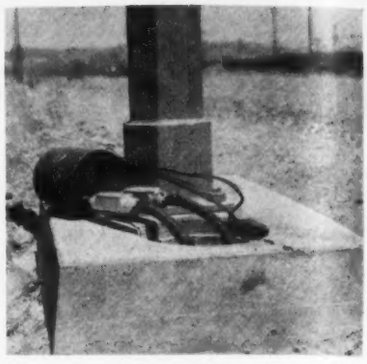
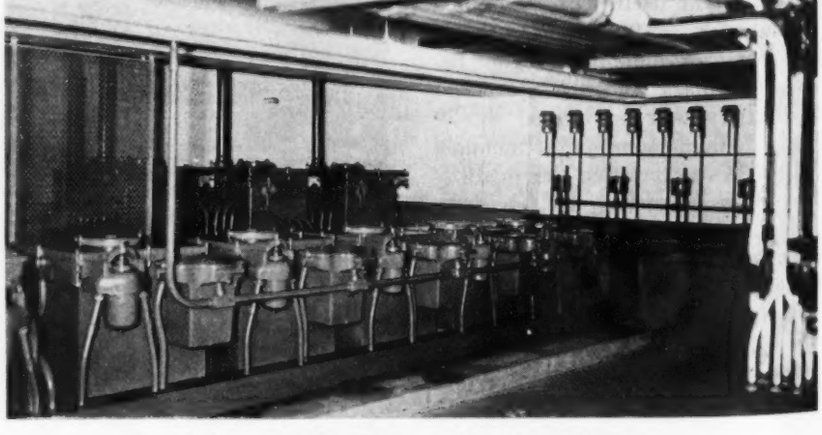


**Series transformer goes in concrete base of lighting standard**

The leads to transformer slip back into the circular recess and are covered with a steel plate, making the entire installation easily accessible.



**Substation (No. 5) located at the toll plaza**

At this station incoming power from the Oakland side is transformed to 2,400/4,150 volts Y by the transformer shown at the rear. In the foreground are the street lighting regulators upon which are mounted the single-pole oil circuit breakers and the oil-filled fuses of each street lighting circuit. For single-conductor lighting circuits, conduits are of brass to eliminate hysteresis losses. The box gutter at the base of the street lighting regulator mounting path and the compact arrangement of equipment is a feature of the design of this station. On the right wall are located (top) the lightning arresters for each street lighting circuit and (below) transformers which operate the indicating lamp circuits. Sectionalizing oil circuit breakers for this station are at the extreme right and are not visible here.

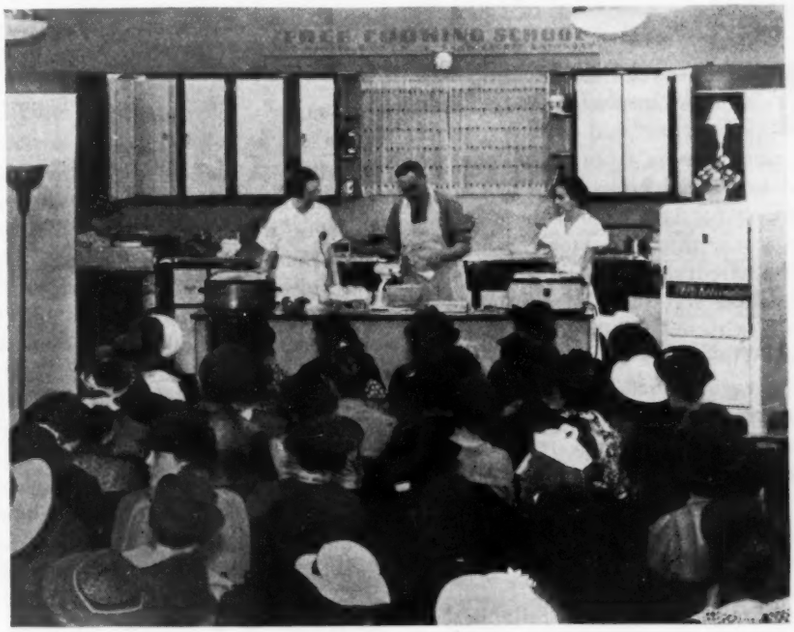
# "Electricooks"— A New Load Builder

## Electric Roasters Bring New Load as Customers Welcome This Electric Cooking Evangelist

"IT'S THE only appliance that has yet come along that can compare with the flatiron from the viewpoint of maximum service to the customer." With such enthusiasm does A. D. McLay, assistant sales manager of the Detroit Edison Company, express his opinion of the electric roaster—or cooker or baker or whatever you want to call it. And well may Mr. McLay be enthusiastic about these 1,000-watt load builders, because in less than two years nearly 20,000 have attached themselves to the lines of his company. Which is pretty nearly a true way of saying it, for these things sell so easily when their merit is known that they almost appear to walk out by themselves.

Although a considerable proportion of the production of "electricooks" to date has gone into Detroit Edison territory, this company is not by any means the only one that has discovered the surprising load-building potentiality of the new device. Commonwealth Edison and other dealers have sold about 21,000 of them in the Chicago region and the Oklahoma Gas & Electric Company has inspired the sale of about 2,000 in its state, where utility merchandising is prohibited by law. Several other companies also have taken the electricook to their commercial bosoms and have found it a very lovable and helpful child indeed.

There are two particular virtues that belong to the electricook. Probably the most immediately important one from the utility standpoint is that it brings the advantages of electric cooking to many customers who can well afford it and who would have had it long ago were it not for the difficulty of getting it. The reference is to the many thousands of apartment dwellers in buildings inadequately wired where electric ranges are beyond all present hope, but where convenience outlets are not wholly unknown. The second virtue is that the electricook is a low-cost evangelist for the electric range among customers that are practicable range prospects. One of the things that keeps the electric range sold is the excellence of its performance in gastronomic appeal, and people who have tasted of the water are the ones who come back to drink at the well.



**Commonwealth Edison teaches electricooking**

During the month of June the buyers and prospective buyers of electricooks in Chicago flocked to 44 cooking schools conducted at seven different locations over the city. It is estimated that more than 8000 women attended these schools.

But to return to the Detroit Edison Company and its experience with the electricook. It was back in 1934, when the electricook was just in the adolescent stage of development from its childhood as a little casserole, that the company became interested. Observing the lusty youngster and seeing the promise of its future the Detroit Edison people decided to give it a boost. A sales activity beginning November 15, 1934, and aimed at the Christmas trade was undertaken. Newspaper advertising, bill stuffers, radio spots and demonstrators in dealer and company stores told the public about this new service of electricity and the public responded by marching up with the money for 3,200 electricooks by the end of the year. It is difficult to determine accurately or even to estimate very satisfactorily how many were sold in 1934 before the drive began, but it is probably safe to say that the sales total of the year amounted to nearly 4,000.

A happy feature of electricook selling in the Detroit area is the way in which the dealers have participated. As a natural result of its pioneering activity the utility made about 75 per cent of the sales in 1934. Since then

[*Continued on page* 102]

# One Breakdown Strength 3 Microseconds to 3 Cycles

## Research Discloses Plateau Below 50,000 Microseconds Has Important Bearing on Co-ordination of Insulation

By V. M. MONTSINGER
General Electric Company, Pittsfield, Mass.

THE 60-cycle dielectric strength of solid insulation and of solid insulation and oil in series, ranging in time from about one second to several hours, is well known. Also, some data have been available for two or three years on the impulse volt-time curve of breakdown of solid insulation and of solid insulation in series with oil for short periods of time. These data show that the breakdown strength decreases quite rapidly from near zero time down to about 3 microseconds. It then remains constant as far as tested, for 15 to 20 microseconds for pressboard and oil in series and 800 to 1,000 microseconds for solid insulation (thin sheets of linen paper).

So far as is known no reliable data have been available until recently on the breakdown characteristics of the heavier insulations (pressboard) for periods ranging from about 20 microseconds to 1,000,000 microseconds (one second), which represents a large gap. This gap is a very important one from the standpoint of co-ordination of insulation, for two reasons: First, field investigations have shown that lightning waves having a duration over 15 to 20 microseconds are quite often imposed on a substation and the connected apparatus. Second, this apparatus is also subjected to switching surges where the transient voltage may last from one-half cycle to a few cycles.

### *Pressboard shows surprising characteristic*

Results of single-shot breakdown tests recently made on 1/16-in. oil-treated pressboard immersed in 25 deg. C. oil, where the time ranged from a fraction of a microsecond to 480,000,000 microseconds (8.16 minutes), are shown in the figure accompanying. A 2.5 x 40 positive wave was used in making these tests. Overvoltages were applied to obtain the short-time breakdown values which were measured by the cathode-ray oscillograph. It will be noted that the curve can be divided into three distinct regions as explained in the illustration.

It has not been possible to derive any single equation of "breakdown vs. time" that fits the entire curve of breakdown, and it is very doubtful if one can be derived. It has been shown, however, that from 1 second to a few hours time the curve can be expressed by a general equation of the form

$$KV = K\left(a + \frac{1-a}{\sqrt[4]{T}}\right) \ldots\ldots (1)$$

where
$K$ = the one minute strength.
$a$ = constant generally less than unity, the value depending on the material, temperature, etc.
$T$ = time in minutes.

The 60-cycle test points so far obtained on this particular material indicate that the value of $a$ in equation (1) is 0.35. This means that the long-time strength is 35 per cent of the one-minute strength. The shape of this part of the curve is not of very great importance in the co-ordination of insulation, other than it shows the one-minute breakdown value from which the impulse ratio can be determined.

The ¼-cycle breakdown points were made by applying a ½ (60-cycle) wave starting from zero time. Breakdown occurred on the crest. Solid insulation when subjected to an impulse wave seldom breaks down beyond the crest of the wave, breakdown being either on the front or crest, depending on the magnitude of the applied voltage.

It will be noted that there was very little change in the breakdown values when going from ¼ cycle to an alternating voltage of 3, 7, 11 and 18 cycles of 60 cycles frequency.

### *Time mechanism not broadly applicable*

Aside from the practical value of knowing the shape of the complete volt-time curve of solid insulation, as mentioned above, there is the interesting question of the mechanism of breakdown throughout the entire range of time. The general theory of breakdown has received, perhaps, more speculation and experimental attack than any similar subject within the past few years.

In 1904 Townsend attributed the breakdown to ionization by collision and in 1922 K. W. Wagner proposed the pyroelectric theory. This was later modified by Karman, Rogowski and Drefus. Around 1928 Fock gave a complete mathematical solution for both the resistivity law and the dielectric loss law. In any of these theories, it is questionable whether very short "time intervals" were experimentally investigated.

It seems quite certain that a mechanism in which "time" plays an important rôle, as it apparently does in region C, does not apply to the entire curve; otherwise, the dielectric strength would not remain so nearly constant over so long a period of time—from about 3 microseconds to 50,000 or 100,000 microseconds.

Just why the breakdown strength remains approximately constant in region B and then increases in region A is not definitely known. Two or three possible causes for the increased

strength in region A are (1) burning or disruption (or both) of the fibers from corona discharges in which time is a factor, and (2) the presence of the oil in the pressboard may tend to increase the breakdown strength. A volt-time curve of oil presented by P. Bellaschi during his discussion of the author's recent paper entitled "Breakdown Curve of Solid Insulation," presented at the A.I.E.E. winter convention, showed a more marked increase in breakdown strength for very short intervals of time than is obtained on solid insulation.

Another possible explanation is that the breakdown from near zero to 3 microseconds time is by ionization by collision of the electrons with the molecules during which period "time" is a factor. Beyond this "time" nothing really happened (when the voltage is slightly less than 3 microseconds breakdown value) until either heating or corona, or both, enter as a factor.

### *Possible explanations advanced*

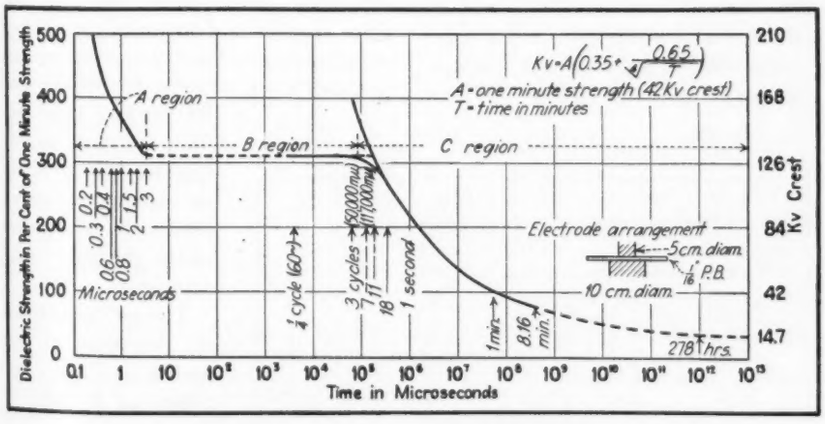
As to the effect of the sharp edges of the electrodes on the shape of the curve, regions A and C were probably affected to some extent, since most of the breaks (90 per cent or over) occurred at or near the edges.

Electrodes with well-rounded edges may have given a smaller increase in strength in region A, but it does not seem reasonable that the strength can remain constant all the way back to zero time even in a uniform field. There must be a bending up of the curve somewhere since the strength is infinite at zero time. But apparently region B was not affected as the ¼- to 18-cycle breaks were scattered over the entire surface of the electrode.

The reason for using square-edged electrodes instead of electrodes producing a uniform voltage field was because, as stated above, for co-ordination purposes it was desirable to know the shape of the curve under the worst electrode conditions because many insulations in electrical apparatus are not in uniform fields. To test solid insulation as a *material only*, a uniform dielectric field should, of course, be used.

It may be questioned whether the dielectric behavior of a single sheet of pressboard is the same as some of the insulations used in transformers, principally between the windings where oil is used in series with the solid insulation. Many tests have shown * that the 60-cycle strength vs. time of voltage application is for all practical purposes the same for solid and oil in series as for all solid. As previously mentioned, this seems to be true also for very short intervals of time, from near zero to 3 microseconds. Being so similar for regions A and C, it seems reasonable to assume that the same similarity would hold for region B, the flat part of the curve.

* "Effects of Time and Frequency on Insulation Tests of Transformers," V. M. Montsinger, *Transactions* A.I.E.E., Vol. 43, 1924, page 337.




**Breakdown curve has long flat region**

Volt-time curve of breakdown of 1/16 in. oil-treated pressboard in oil at 25 deg. C. Breakdowns in A region occurred on crest or front of wave. The first region, marked A, extends from zero time to 3 microseconds. In this region the dielectric strength decreases quite rapidly as the time to breakdown increases. This portion of the curve agrees very closely with the average of the data recently published on barriers composed of solid insulation (pressboard) and oil in series tested between a flat plane and a square-edged electrode.

The second region, marked B, starts at the 3-microsecond point and extends to about three cycles (50,000 microseconds). The dielectric strength is seen to be approximately constant throughout this region.

In the third region, marked C, the strength again decreases, rapidly at first, and then more slowly, and gradually again becomes constant.

In connection with the bend upward in the curve in region A it is well to point out that this represents the single-shot breakdown characteristics of a pad of insulation. Other tests have shown that on a multiple-shot basis the bend upward is much less. Transformers must of course be capable of withstanding many shots, consequently it is not safe to count on very much increased breakdown strength over that of the B region (for multiple shots) for real steep waves under service conditions.

### *Meaning to insulation coordination*

From a practical standpoint the principal conclusions to be drawn from the curve presented are:

1. The stresses imposed upon the windings of a transformer by lightning surges depend upon the magnitude of the voltage and its duration. The magnitude of the voltage which may be applied to a transformer winding is limited by the flashover of the bushing. Inasmuch as the impulse ratio of the bushing is only slightly in excess of unity for long lightning waves, the overvoltage to which the winding is subjected from such waves is correspondingly slight and is less than the demonstrated strength of the transformer. Consequently, as far as magnitude is concerned, and neglecting the dangerously high internal voltage oscillations which may be set up within an unshielded transformer by lightning waves, long lightning waves are not very dangerous. Long impulse waves, however, may be dangerous to transformers from the standpoint of causing oscillations to be set up within the windings, to a value considerably in excess of the applied wave, unless provision is made to prevent internal oscillations.

2. Maximum switching surges under certain conditions may be dangerous to unshielded transformers, namely, when there is a sustained oscillation and the frequency of the oscillation approaches one of the natural periods of the transformer.

It is well known that switching surges may reach, from time to time, about 5½ times normal line to neutral voltage. Five and one-half times line to neutral voltage of a 230-kv. circuit is 1,030 kv. crest. The maximum A.I.E.E. impulse test is the 105 per cent impulse flashover of a 230-kv. bushing, or 1,195 kv., which is 16 per cent above 1,030 kv.

If a transformer winding can oscillate under switching surges it is quite easy to see that the built-up internal voltage may, under the worst conditions, considerably exceed the 16 per cent margin between 5.5 times normal and the demonstrated impulse strength. However, in cases where internal oscillations cannot occur, as, for instance, in shielded transformer windings, switching surges are probably not dangerous. This statement

[*Continued on page 104*]

# Short-Wave Radio for Economical Communication

## Low-Cost Installation Serves 30-Mile Stretch Where Other Communication Was Lacking or Was Not Feasible

By C. M. LINDSLEY

Radio Engineer Southern Sierras Power Company, Riverside, Calif.

RECENTLY the need arose for communication between the Randsburg substation of the Southern Sierras Power Company and the plant of the Pacific Coast Borax Company, about 30 miles southwest of Randsburg. The 30-mile metallic circuit necessary would involve a comparatively heavy investment for light traffic to be carried. Carrier-current equipment on the existing 33-kv. transmission line, while less expensive, also represented a higher cost than the limited amount of traffic warranted. Thus it was that radio was considered to solve the problem.

Normally used radio channels already are crowded, making it very difficult to justify any such application to the Federal Communications Commission. Furthermore, to operate on the usual frequencies requires precision apparatus to insure purity of emission, wave form, frequency control and modulation, all of which would add to the cost. It would also be necessary to have commercial class operators in continuous attendance.

If, however, the so-called ultra-high-frequencies could be utilized the picture is changed considerably. As frequencies above 75,000 kilocycles are not in general use, and as little information is available concerning their behavior, the F.C.C., to a certain extent, encourages development and research in these regions. Requirements as to equipment and operators are considerably less rigid. Accordingly, experimental work was decided upon to determine if such frequencies could be utilized in the present instance.

While the two terminals were not within actual visual range of each other, most of the other important considerations seemed to be nearly ideal. The elevation of Randsburg is 3,500 ft. The other terminal is about 1,000 ft. lower. Both points are provided with reliable commercial power supply, eliminating the need of emergency power equipment at Randsburg and necessitating only the installation of a small dynamotor at the other terminal. Transmission would be over a level desert having only two low mountain ranges which might affect the radiations.

### *Directional beam adopted*

Preliminary field tests were made with antenna installations of the same type normally used at lower frequencies. Results were distinctly unfavorable. The effective range was apparently very limited, and while a signal was actually sent from one terminal to the other it was unreliable and of little use for practical work. Increase of power did not seem to help matters. After experimenting with various types of antennæ a directional beam was tried. This immediately improved matters greatly. An eight-element broadside array was finally decided upon as offering the best propagation characteristics with simplicity and economy of construction. It was also determined that the same type of array for the receiving antenna improved reception to a marked degree.

This type of antenna, illustrated by Fig. 1, has four vertical radiators, each one-half wave in length and spaced one-half wave apart, excited by the feeders strung along the lower ends. The two center radiators are excited in phase and the two outside radiators are excited in phase but displaced 180 deg. from the center elements. Each radiating element is backed by a reflector, also one-half wave in length, and placed one-quarter wave back from the radiator. These lengths and spacings were found to be critical. On the particular frequencies used, namely, 87,500 kc. and 90,000 kc., a discrepancy of 1/4 in. in spacing and 1/2 in. in length made a noticeable difference in the radiating characteristics.

The set-up as finally developed and shown in Fig. 2 operates as follows:

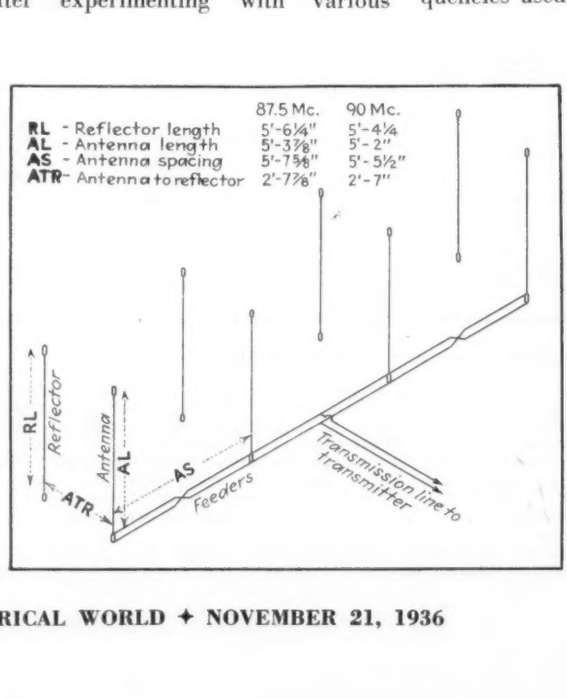



**Fig. 1—This directional beam antenna made short-wave communication possible. Lengths and spacings are very critical for maximum signal strength**

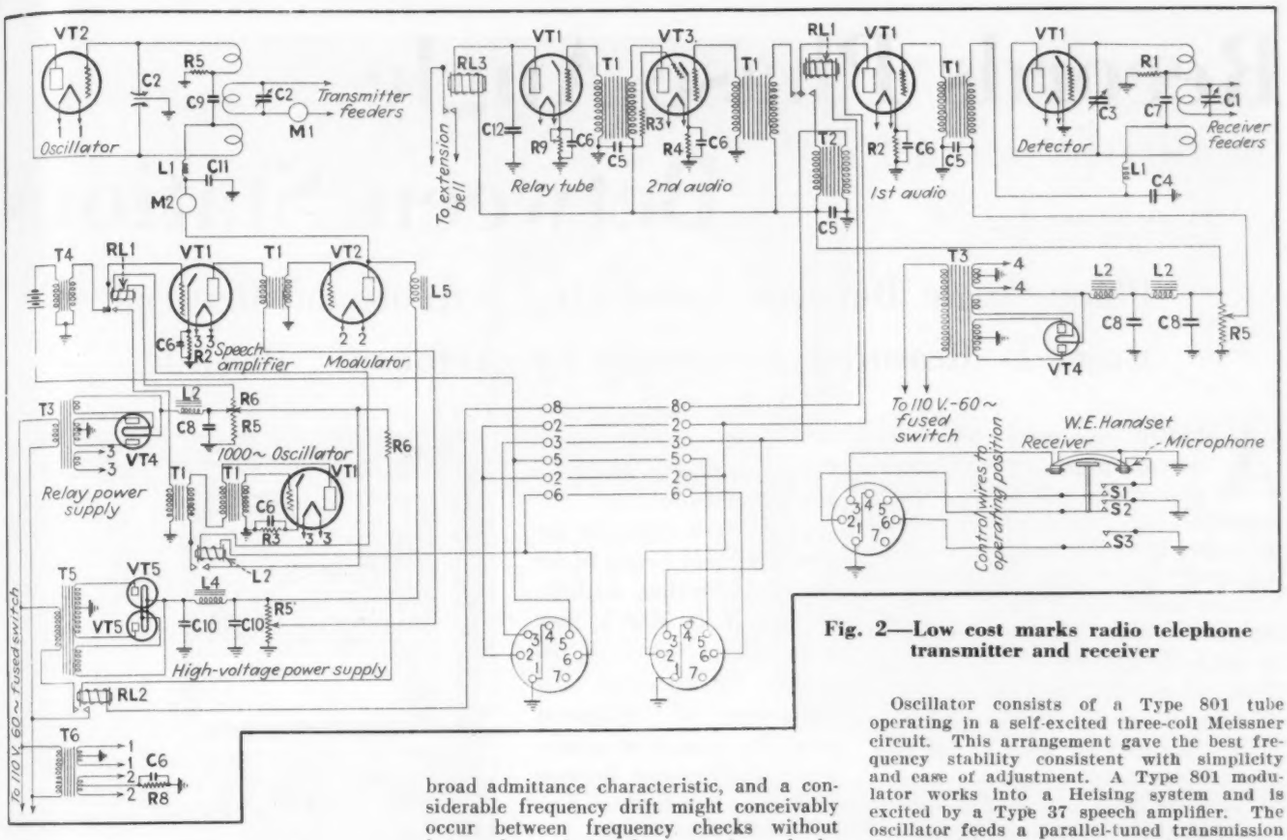



**Fig. 2—Low cost marks radio telephone transmitter and receiver**

Oscillator consists of a Type 801 tube operating in a self-excited three-coil Meissner circuit. This arrangement gave the best frequency stability consistent with simplicity and ease of adjustment. A Type 801 modulator works into a Heising system and is excited by a Type 37 speech amplifier. The oscillator feeds a parallel-tuned transmission line one full wave in length, which in turn excites the antenna system. The rest of the transmitter is more or less orthodox.

The receiver consists of a self-quenching super-regenerative detector using a Type 37 tube. This is followed by the necessary audio stages. One audio stage is used for conversation, but in the idle position a second audio stage is used feeding into a relay tube for extension circuit ringing. The antenna feeds the receiver by means of a twisted pair transmission line of any convenient length, tuned at the receiver end, and fanned at the antenna end to allow matching impedances. It is probable that a super-regenerative detector using a separate tube for generating the quenching frequency would provide greater flexibility and sensitivity. In the interests of stability and simplicity, however, it was decided that the self-quenching stage was satisfactory for this particular installation.

Normally there is no carrier on the air. All transmitter tube filaments are heated except the two Type 81 rectifier tubes, VT5. The relay, RL2, in the primary of the power transformer, T5, is open. The receiver is in an operating condition at all times, but normally relay RL1 is not energized and the output is fed from both audio stages into the relay tube. When it is wished to operate the circuit the Western Electric handset is lifted from the stand. This closes switch S1, which places the microphone in the speech amplifier circuit. Switch S2 is also closed by the lifting of the handset. This closes relay RL2, in the primary circuit of the transmitter power transformer, T5, and applies plate voltage to the oscillator and modulator stages, placing the carrier on the air.

Closing of switch S2 also closes relay RL1 in the plate circuit of the first audio tube in the receiver. This disconnects the output of this tube from the next audio stage and the relay tube and connects it through the primary of transformer T2. The output of this transformer is connected to the receiver of the Western Electric handset by a low impedance line. The carrier is now on the transmitter to the antenna by a tuned transmission line.

In the first place the efficiency of the transfer was found to be adversely affected by feeding the antenna direct from the transmitter, due to the necessity of placing the transmitter directly in the field of the radiators. Also, the antenna system itself tunes very broadly and will radiate efficiently over rather a wide range of frequencies.

A transmission line, on the other hand, can be tuned much more sharply and will transfer the energy efficiently only over a very narrow channel. Any frequency deviation in the carrier is therefore noticed at once, by the radiation dropping off rapidly. This is important as the super-regenerative type of receiver used has a broad admittance characteristic, and a considerable frequency drift might conceivably occur between frequency checks without being detected in the operation of the circuit.

Flexible and easily operated frequency measuring equipment presented some difficulties. Under the "general experimental" classification under which these stations were built the frequency tolerance was specified as 0.05 per cent, or 45 kc. at 90,000 kc. carrier. It was finally found that an electron-coupled oscillator designed for 10,000 kc. and periodically checked against WWV standard frequency transmissions provided a check to the necessary degree of accuracy. By beating the ninth harmonic of this oscillator against the transmitter carrier an indication of frequency drift is provided that is sufficiently accurate to keep the frequency within the limits specified. As a matter of fact, the transmitters have proved to be surprisingly stable and no undue difficulty from frequency drift has been noted.

### *Performance has been satisfactory*

While still in the observational stage, this equipment gives every indication of performing satisfactorily. The cost of this particular installation was considerably less than would have been any orthodox type of communication channel. The total cost of any such job would naturally be affected by a number of factors, including the location of the terminals, type of power supply available, physical conditions of the surrounding country and whether the equipment was composited or purchased direct from a manufacturer. The cost of the component parts of the entire layout amounts to approximately $200 per terminal for such a set-up as described. To this must be added the cost of assembly, installation, testing, etc.

It appears that such installations may have a very definite place in many power company communication systems and to offer an economical and reliable circuit, in many cases falling within the limits of the ultra-high-frequencies.

# Records Phase Angle Between Stations

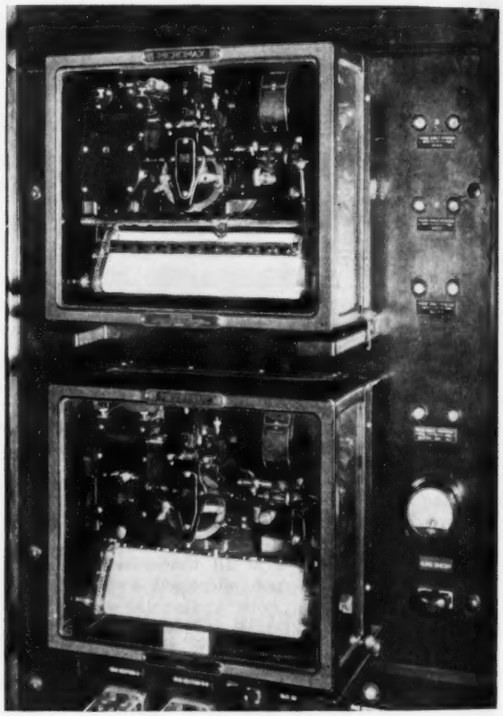
## Phase Angle Between Generating Stations and Between Buses Is Measured Accurately by Automatic Recorders

A MAJOR problem in the operation of any a.c. network system that synchronizes the various generator and feeder buses through the network load is that of maintaining small phase-angle displacements between the different buses. This is desirable in order to prevent backfeed on tie feeders between generating stations and to minimize false operation of network switches that are in areas jointly supplied by feeders emerging from different station buses.

Since the principles and problems involved in the operation of any network system in this regard will be much the same, any instrument which would aid operators in maintaining low phase-angle values could find wide application. Indication of phase-angle displacements between buses or stations would permit operators to maintain small displacements by relative adjustment of the generation on the different buses or by some other method such as selection of the proper taps on load ratio control transformers.

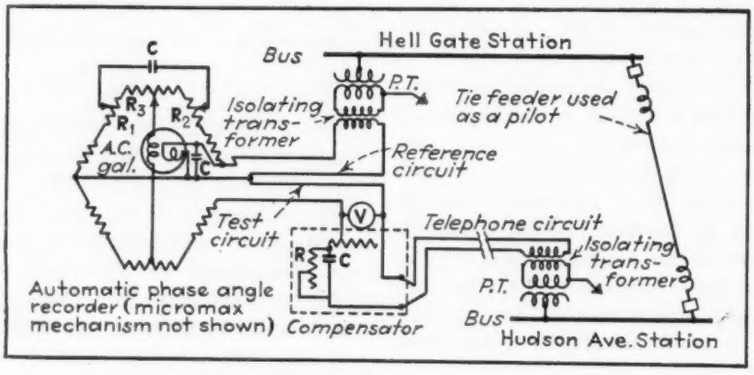
In a paper presented before the Power Group of the New York Section, A.I.E.E., recently R. L. Morris, New York Edison Company, described the operation and calibration of equipment used for measuring phase-angle displacement between Hell Gate and Hudson Avenue stations.

Of several circuits investigated, a modified form of the circuit used in a potential transformer test set was found to give the most promising results. In operation, this instrument is set up at Hell Gate, as shown in the accompanying diagram.



**Phase-angle recorders and their associate equipment installed at Hell Gate**

Top instrument measures difference in phase angles between Hell Gate buses. Bottom one between Hell Gate and Hudson Avenue stations




**Automatic recorder measures differences in station phase angles accurately to 0.1 deg.**

Current is sent over a telephone line from a potential transformer at Hudson Avenue. Potential received at Hell Gate is compensated for the phase displacement error introduced by the telephone line and this potential is applied across the test circuit of the recording instrument. Phase displacement between the two station buses will cause current to flow in the galvanometer coil, resulting in deflection either to the right or left, depending upon whether Hudson Avenue is leading or lagging. Deflection of the galvanometer needle upsets the balance on an automatic clutch mechanism which operates the three-gang potentiometer ($R_1$, $R_2$ and $R_3$) to bring the bridge back into balance. Turning of the potentiometer unit moves a pen across a calibrated, uniformly moving chart. When the position is such that balance is restored in the galvanometer, the potentiometer becomes stationary. Thus the pen is made to draw a continuous record of the magnitude of phase displacement on the chart.

Initial calibration of the Hell Gate-Hudson Avenue recorder is accomplished by obtaining a zero load transfer condition of a pilot feeder between two stations. The compensator is then adjusted until the instrument indicates zero.

Large errors may be introduced by the connecting channel used to convey the test potentials from the distant bus to the instrument. Of several methods considered, a metallic telephone circuit seemed to be the most practical. However, a 16-mile telephone circuit interposes an angle of about 30 deg. due to its resistive and reactive components. If phase-angle displacements of one degree or less are to be meas-

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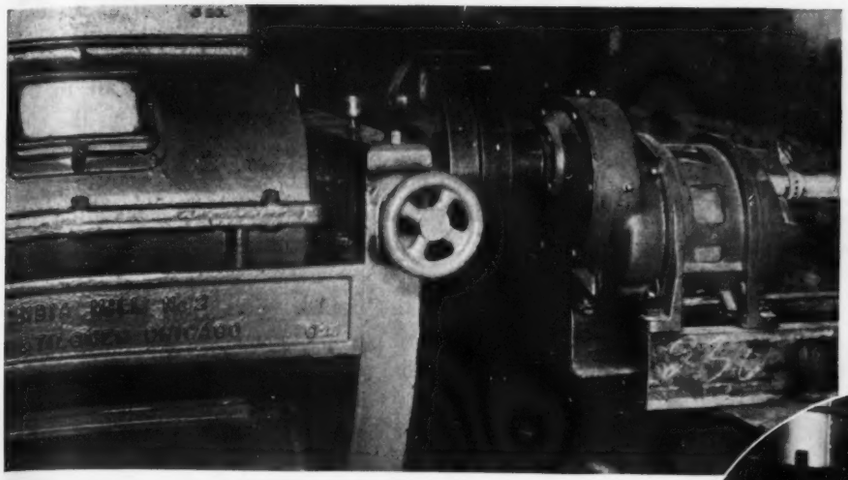
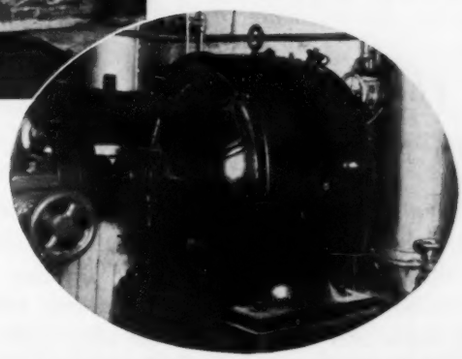
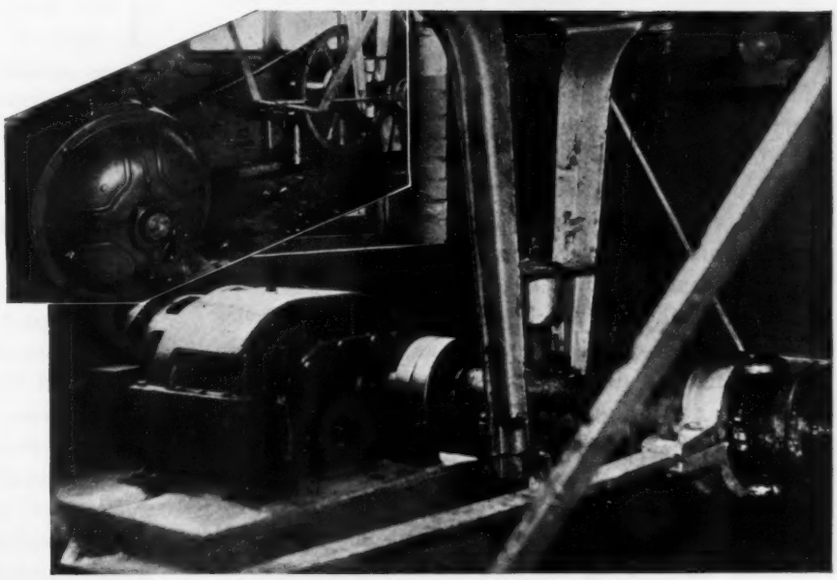
# Brewery Saves Through Modernized Drives

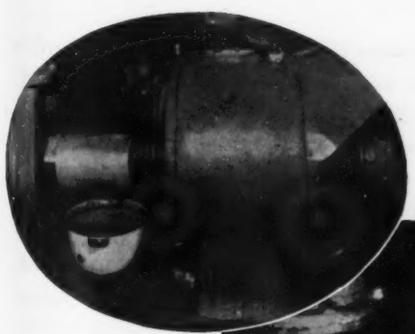


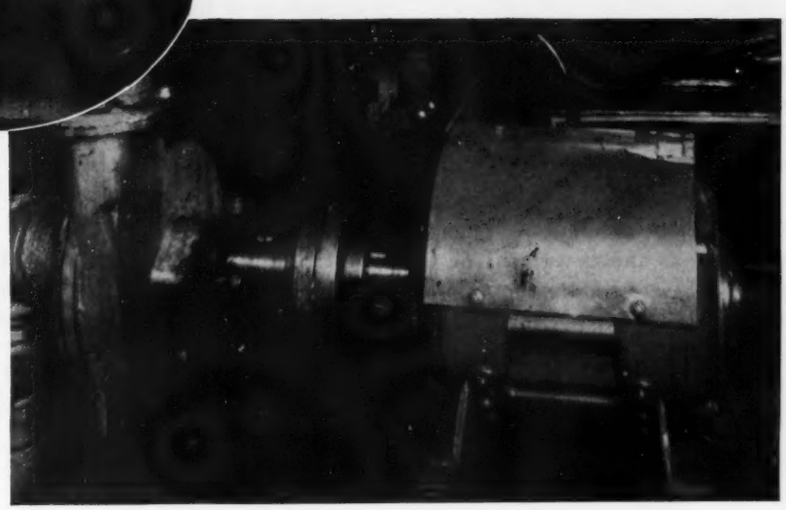


Malt mill drive now uses a 5-hp., 486-r.p.m. gearmotor to replace the 15-hp., 485-r.p.m. motor shown in oval

Savings in power costs alone of more than $600 a year resulted from the installation at the Forest City Brewery, Cleveland, of modern a.c. drive equipment. Power for the replaced d.c. machines was formerly supplied by a steam-driven 37½-kw. generator. Since it was necessary to run the generator often on partial load and to keep the boilers on the line, power costs were unusually high, averaging about 4 cents per kilowatt-hour, whereas purchased power cost 1.65 cents. The new drive equipment, supplied by Westinghouse, has cut maintenance considerably, through elimination of the old prime mover.







A 25-hp. variable-speed d.c. motor replaced by 10-hp., 1,150-r.p.m. motor as beer pump drive. Old installation at the upper left

A 10-hp., 97-r.p.m. gearmotor drives mash tub formerly powered by a 15-hp., 500-r.p.m. d.c. motor and chain drive, also shown

# Editorials

HOWARD EHRLICH . EDITOR

## *Better Than a Shotgun Ceremony*

FOR a long while the power companies have been flirting with domestic load. But the time is coming when they will have to settle down together to regular married life. Either the utilities will make the arrangements and march up to the altar smiling or there will be a shotgun wedding, with Old Man Economics holding the gun.

The point is that the whole business of electrifying the home has been highly appealing as a public service and deeply gratifying as an achievement. So the industry has gayly gone forward with the courtship, thrilled with the increasing response from the market and confident that the Lord loves lovers and will provide. But admiration, order and enthusiasm alone will not maintain a home.

Up to now the development of this basic service that the power company renders has followed the plan of the empire builders. The territory has been penetrated in every direction. The possibilities for utilizing electricity have been explored. The gospel has been preached. Capital, organization and science have been harnessed to the plow of industry and brought forth harvests. Prosperity and plenty have followed in their turn. Then the pioneers have pressed on to new frontiers.

In plainer words, one after another electrical appliance has been devised to bring new comfort and labor saving to the home and electrical men have gone out and sold them by the millions. Load has grown. Rates have come down. The standard of living in American homes has risen. Now what?

We come to a new phase in the evolution of the service. Saturation lies far ahead and never will be actually reached. But the number of appliances sold for replacement is steadily growing and the improvement of these devices means that many of these replacements will reduce load somewhat, not increase it. Also, larger consumption gives the customer a cheaper rate. So the number of appliances begins to lose some of its old significance. The frontiers have passed and we now settle down to living in the country.

There are millions more ranges, refrigerators, water heaters, ironers, washers, cleaners still to be sold that will be clear gain on the line. But the old idea of reckoning the value of sales in estimated annual revenue no longer fits the situation. Cost per dollar of merchandise sales and cost per dollar of indicated revenue no longer tell the management what it must know.

As a result the industry stands in dire need of accurate, embracive cost accounting on sales. The old practice of guessing what new business is worth has broken down. The cost of sales becomes each year more vital to the conduct of this business, as sales become more dominant in the business. The lack of uniformity in merchandise accounting is preventing companies from comparing their commercial proficiency. It is time to face this fact—before lack of data leads into serious trouble.

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## *Lightning and Atmospherics*

THE study of nature's great electrical phenomena, lightning and the potential of the earth, advances steadily if slowly. Research in these fields cannot be controlled nor guided, and the student must be a more or less passive observer, waiting for things to happen, and be exceptionally quick when they do happen. The interest in these great questions is widespread—for the geophysicist, because of their relation to the larger question of the nature of cosmic laws; for the practical scientist and engineer, because of the powerful part they play in his affairs, and even for the layman, because of his realization that these mysterious forces and happenings must be closely related to nature's secrets.

New observations of lightning and of the earth's potential gradient are reported in the October, 1936, number of *Physics*. For the former, the moving camera reports a type of lightning breakdown that apparently has not been previously recorded, namely, a succession of flashes following the same path but of progressively greater length, the final one only reaching the earth and showing the Schonland leader stroke. The authors of the paper, Messrs. Workman, Beams and Snoddy, point out a possible new mechanism for explaining the results mentioned, and others of progressive and periodic character noted by other observers. The basis of the proposal is the well-known property of a series of capacitive spark gaps, by which an impulse voltage applied to one end will pass progressively down the series of gaps, rupturing them in turn.

The paper on atmospheric gradient by F. L. Cooper reports observations on the earth's surface potential gradient over a period of six years and in-

dicates clearly a sharp periodic variation closely related to the rotation of the sun. Comparison with the record of sun spots leads to the conclusion that the variations in question synchronize almost perfectly with the passage of sun spots across a line from the earth through the center of the sun. Present theory indicates that the nature of the influence is that of radiation, but is not explicit as to the mechanism. Of special interest is the evidence of the sharpness of the variations in the potential gradient, often with complete reversal of sign.

While the two papers referred to are not related to each other, when read together no great stretch of the imagination is required to suspect that forces so profoundly influencing the potential gradient at the earth's surface may also have a hand in causing those vagaries of thunderstorms and lightning discharges which are beyond prediction and control, and against which such careful precautions have to be erected in electric power transmission and utilization, as well as in the ordinary activities of life.

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## *A Pile of Coal Went Into Power*

THAT an increase of activity in any given industry brings expanded operations in other lines is obvious, but it is not always possible to measure the extent of this interaction.

In the case of public utilities, current statistics are available from which the chain of cause and effect can be traced at least in part. Attention has been called in the pages of ELECTRICAL WORLD to the much larger production of energy in fuel-burning plants during the past summer than in the summer of 1935, due to the heavier demand for energy combined with a deficiency in water power. Thermally produced energy in June, July and August increased 31 per cent compared with last year.

As was to be expected, the consumption of fuel rose correspondingly. From data published by the Federal Power Commission this rise can be expressed numerically. During the three months this year the utilities used about 10,910,000 tons of coal. A year ago they used 8,550,000 tons. The increase was close to 2,500,000 tons, equivalent to 29 per cent of the consumption in the summer of 1935.

To get a proper perspective of the significance of these figures to the coal mining industry it should be noted that the average annual production of coal during the five-year period ended in 1934 was about 400,000,000 tons. Electric public utilities in 1935 used nearly 35,000,000 tons and thus accounted for one-eleventh of the total tonnage mined.

Other fuels were similarly affected. Utility consumption of fuel oil increased by 31 per cent to 3,680,000 barrels; an additional ten billion cubic feet of natural gas brought the total for that fuel nearly to 44,000,000,000.

These are huge quantities. Aside from the employment involved in their production, these fuels had to be conveyed to the points of consumption, giving work to other hosts of railroad and pipeline employees, and, in turn, to still others in various tributary industries.

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## *Farmer Must Buy More Than Electricity*

WHEN, a year or so ago, ELECTRICAL WORLD had the temerity to publish certain figures showing that the farmer must buy more—in fact, quite a bit more—than just electricity in order to realize the benefits of electric service, several in official positions took exception. The figures then published were not actual data from the field, but were amounts calculated from basic statistics in what was considered by our critics to be a manner not warranted by the facts.

But now we have some actual field data. They bear out quite definitely the conclusions stated in the previous presentation. They prove that the farmer must make a substantial investment in wiring, appliances and power equipment if he is to use electricity in such quantity as to mean anything, either to him or to the supplier of power. You will find these data on page 82 of this issue. We think it is important to establish that the farmer has to lay out for wiring and equipment from sixteen to twenty times his annual bill for electric service. The story appeared originally in the "C.R.E.A. News Letter," from which, with permission, we repeat it.

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## *Mine Distance Lends Rectifier an Enchantment*

HAULAGE distances in coal mines are increasing at the same time that mechanization for undercutting and loading proceeds. As a result, the prevailing d.c. distribution systems in the respective levels are taxed up to or beyond their capacity. Of course, a.c. at higher voltage affords an answer, but it also calls for extensive outlay if the rehabilitation is complete.

Reports have it that many mines are using the mercury arc rectifier with great advantage in the transition period. It makes possible the retention of the d.c. motors, but at the same time it permits all the economy of copper and gain in production through well-maintained voltage. Thus the scheme of placing rectifiers at the load concentration points is cashing in on the still unreconciled virtues of alternating and direct current in the fields of distribution and of motor application.

# Opportunity Bows to Security

ONE of the worst beaten major party candidates for the presidency up to then was Alton B. Parker, the "sage of Esopus," Democratic nominee in 1904 against Theodore Roosevelt. In a spectacular campaign Mr. Parker laid a great deal of stress on the wickedness of the big life insurance companies.

At the time Judge Parker was held up as little short of a traitor to his country—a man who would befoul his own nest, a man who would callously exploit the funds of widows and orphans, held by these revered trustees. That sort of thing. The truth is, the country was just a little shocked at and disgusted with what it considered such dirty politics.

But along came an investigation. The charges of Judge Parker were abundantly proved. A young lawyer named Charles E. Hughes became Governor of New York, and almost became President of the United States, on the record he made in uncovering the iniquities Judge Parker had attacked.

Parker sowed—Hughes reaped. Yet no one has ever given Parker much credit for having brought about such a drastic reorganization and reformation of the conduct of our big life insurance companies.

Nor will anyone give Gov. Alf M. Landon much credit for some of the things he started in the campaign just closed. Meaning the gentleman from Kansas who so completely obliterated the Parker record for taking a bad beating. Yet the parallel may be fairly close. It didn't do Parker any good, politically, for his campaign charges to be proved *after* he had been defeated. It didn't even do his party any good. Mr. Hughes happened to belong to the opposite party.

ONE of the points on which Governor Landon laid great stress was that the social security law was a "cruel fraud" on the workers of this country. He particularly deplored the payroll tax, both the part to be paid by the workers, in pay deductions, and the part to be paid by employers, which would be added to the cost of goods which workers must buy.

During the campaign there were many evidences that the workers simply did not believe his charges. The President admitted that there would be a payroll deduction, but pointed out that the employers would also contribute an equal sum. John L. Lewis scoffed, saying pay increases would more than make up for such a trifling deduction. Democratic newspapers screamed "Fake" attacks, etc.

But within ten days after election comes William Green, president of the American Federation of Labor, in an address before a labor gathering at Tampa, and demands repeal of the payroll tax provision of the social security law! He is not fooled in the least by the statement that the employers will pay as much as the workers. He knows that what the employers pay will be added to the prices workers pay for what they buy. He wants this tax repealed and the burden of financing old age pensions placed on "wealth."

ENTIRELY aside from the merits of the case, Mr. Green will find he has lots of allies when such a proposal is laid before Congress in January. Despite Mr. Lewis' scoffing during the closing days of the campaign, it seems likely that organized labor will be squarely back of Mr. Green on this particular point. Both as to the deductions from the pay envelope and the payroll taxes to be paid by the employer.

It is idle to inject the thought that the money *must* come from somewhere, or to resurrect Mr. Roosevelt's 1932 speech that "taxes are paid in the sweat of every man who labors." The point is the country is pretty well sold on the idea, for the time being, that the rich *can* pay the taxes.

Governor Landon's declaration at Buffalo that confiscation of every income from $5,000 a year upward would pay only a fraction of what the government is spending fell on very stony ground indeed. The folks with incomes under $5,000 a year regarded it as just campaign buncombe. The idea that taxes are actually paid every time the housewife buys a loaf of bread simply did not register.

In those rare cases where it did, the retort that at least there was money to buy the bread now—while there wasn't in 1933—seemed a complete answer.

So there will be a tremendous drive in Congress to strike out these payroll taxes, and it is well within the bounds of possibility that the drive will succeed. The situation will be very different then from what it was during the campaign. As a matter of fact, in the campaign the Republicans found themselves punching a pillow on this issue. There was very little hitting back. For instance, there was hardly a word in defense of the 47-billion-dollar reserve fund which is to be piled up for old age pensions.

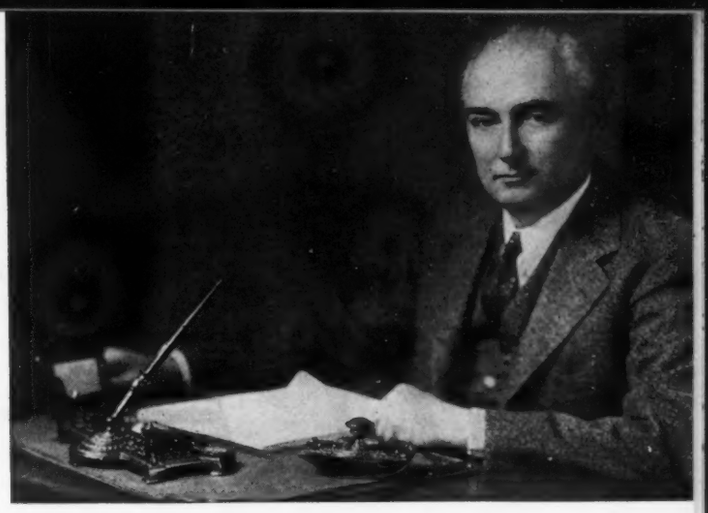
During the campaign the groups most likely to be irritated by this payroll tax were intent on maintaining a solid front for Mr. Roosevelt. But with victory, victory to an almost unbelievable extent, in their grasp, they can now look at this thing coldly, with no concern over giving possible comfort to their "reactionary" enemies.

And what stands out as most obvious about it?

**That the workers of this country will pay off the national debt with their pay deductions and the payroll taxes that they pay in increased costs of the things they buy!**

Starting with Mr. Green's mild statement that this tax must be repealed, attacks on the act will become warmer. They will go further. No longer will there be the taint of reactionism or Republican party politics on such a move. It has been started by a warm supporter, during the campaign, of Mr. Roosevelt, and, of all sources, it has come from a labor leader.

Assume for a moment that this drive is successful, and this is not by any means a violent assumption. At once



## —By CARTER FIELD

***This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.***

disappears the whole purpose of keeping all these records of workers—the length of time they worked, and at what wages, during the years beginning with 1937. As they will not have made any direct personal contributions to the fund there will not remain much point, it would seem, in keeping data about them.

NECESSITY for this enormous federal force, this army of 300,000 clerks, if estimates be not far astray, vanishes. The whole scheme is financed out of the general receipts of the federal treasury, hence no particular bookkeeping as to the *acquirement* of the money is necessary. The scheme then becomes a simple old age pension proposition. It might just as readily be applied to the various classes of people now excluded—farmers, servants, government employees, etc. All that would need to be established on the part of any person to benefit would be the age of 65, and the individual need. This last phase is an old story to the Pension Bureau. It handled it, paying pensions only to soldiers' widows whose incomes were below a certain figure beginning in 1890.

Nor can it be assumed that President Roosevelt will, of necessity, violently oppose such a drastic change. It is true that he did oppose the principles now advocated by critics. In fact, Secretary of the Treasury Morgenthau was almost alone among Administration advisers on this act in insisting upon the piling up of a huge reserve fund. Mr. Morgenthau was terribly anxious to get something started which would balance the budget, eventually.

But while there is no indication that the President has changed, and there is very definite certainty that Mr. Morgenthau has not, a very different situation confronts the White House now from what existed when the law was framed. Then a presidential campaign was imminent. The whole New Deal was at stake. Mr. Roosevelt's own election forecasts, made at various stages of the battle, show that he by no means anticipated the extent of his victory.

Also, it was obvious that the one issue which gave the President and his close advisers the most concern, as the campaign opened, was New Deal spending and extravagance. The lack of a balanced budget was regarded almost as an Achilles heel, to be protected at all costs.

That aspect of the situation has disappeared. The country demonstrated in the huge vote for Mr. Roosevelt that it was not concerned about such details. It demonstrated a complete confidence in the President. Furthermore, he made no definite commitments. Aside from promising to keep up the fight and to move "forward," he promised almost nothing. So he is not handicapped. He defended general policies, and *results*, particularly the contrast between the fall of 1936 and the spring of 1933. All of which leaves him free to move in almost any direction he may see fit.

In fact, such a change as is advocated by Mr. Green in the social security act would provide a perfect excuse for Mr. Roosevelt to do something else on which his heart is set—pursuit of economic reform and economic planning through taxation.

Should Congress repeal these payroll taxes the President with good grace can then insist that new taxes to make up for them must be imposed. The situation would be very much like that which occurred after the Supreme Court knocked out the A.A.A. processing taxes and Congress passed the soldier bonus over his veto.

In this connection it is the view of some very astute observers that this election demonstrated something about the rank and file of 1936 America that some of us who were in the minority had not suspected. This is that the average worker is far more interested in *security* than he is in *opportunity*. Alfred E. Smith talked to cold ears about keeping open that door of opportunity which had enabled him to rise from Fulton Fish Market.

The average worker, even the young one, is more concerned about the assurance of three meals a day and a pension in his old age than in a chance to really get somewhere under the old competitive, root-hog-or-die theory of rugged individualism. Some folks think it was this old system which made this country great, but they are obviously in a rather ineffective minority.

THE changes which Mr. Green desires, and which seem promised a great deal of support, do not interfere with a single one of President Roosevelt's objectives—nor do they run counter to any popular sentiment manifested in the campaign. The chief objection to them, in fact, from the standpoint of most New Dealers —always leaving out Mr. Morgenthau—is that they were sponsored during the campaign by Governor Landon and other Republican speakers.

Which is rather amusing when it is considered that until the campaign was half over there was no Republican attack on the social security act. In fact, the issue was scarcely mentioned before the Kansan's speech at Milwaukee.

But it would not be surprising to see the very points raised by Governor Landon in that speech met—not by Landon's followers—but by the one group of the entire electorate which seemed most solid against him in the campaign—labor.

# News OF THE WEEK

## Georgia Power Contest Pushes Residential Usage to 1,161 Kw.-Hr.

**Average annual domestic consumption for system increased 150 kw.-hr. per year by unique campaign — Celebration dinner on December 4 to salute Mayors of winning towns**

*Special to* ELECTRICAL WORLD

"Woodbine . . . was a double leader in the contest, having won first place in the Sweepstakes competition and first place in the group D competition—a total prize of $1,500," John R. Marsh, manager advertising department, Georgia Power Company, advised ELECTRICAL WORLD this week, as the company's "Home Town Electrical Contest" concluded a twelve-month campaign. "The town plans to spend the money in building a community house on a lot provided by the school authorities. The school is to install an all-electric kitchen in the auditorium for use of its home economics department."

### *Cash prizes for 24 towns*

Unique in the annals of public utility selling technique, the Georgia Power Company contest increased average annual domestic consumption 150 kw.-hr., from 1,010.6 kw.-hr. to 1,160.7 kw.-hr., and twenty-four Georgia towns will receive cash prizes of $10,600 to be used by the towns for civic, charitable or educational purposes. Presentations will be made to the respective Mayors by Preston S. Arkwright, president Georgia Power Company, at a dinner celebration at Atlanta's Capital City Club on December 4 which will be broadcast over station WSB.

Although many of the towns are not very large, the usage is the average for all electric customers in each town and is, therefore, remarkable.

Woodbine (population 335) won with 2,940.7 kw.-hr., an increase of 1,043.3 kw.-hr.; Louisville, familiar to sojourners on U.S. 1, came second with 2,295.2 kw.-hr. as its average annual residential usage. Warm Springs, 2,289 kw.-hr.; Americus, Baxley and Reidsville were among other leaders.

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## P.W.A. Approves Grant for Municipal Plant

*From the Washington Bureau of* ELECTRICAL WORLD

With the U. S. Supreme Court pondering the constitutionality of federal relief allotments for municipal power plant construction, the Public Works Administration on November 14 announced a $2,595,000 grant to the city of High Point, N. C., toward the construction of a publicly owned $6,000,000 hydro-electric generating plant on the Yadkin River near Winston Salem. This will supply energy for the municipally owned distribution system, which now purchases current from a subsidiary of the Duke Power Company.

High Point has a population of approximately 38,000 and in 1933 the last year for which figures are available, purchased 6,500,000 kw.-hr. The load is divided between the municipal and private systems, the power company agreeing not to sell lighting current in opposition to the city and the latter agreeing not to serve any motor of greater than 5 hp.

The city last spring was revealed as the sponsor of the Smith Mountain Power Company, which planned a development on the Roanoke River in Virginia. Complications incidental to the interstate nature of the undertaking and opposition from other sources have apparently led to the substitution of the Yadkin development.

The project includes an earth dam, a reservoir covering 15,000 acres, power station with six direct-connected vertical turbo-generator units and a substation with a capacity of 24,500 kw. The dam will have a maximum height of 84 ft. and a 500-ft. spillway with a discharge capacity of 157,000 sec.-ft. Turbines will be rated at 5,570 hp. each; generators at 4,150 kw. Average operating head will be 63 ft., utilizing only the upper 20 ft. of the reservoir. Water will be drawn from the reservoir through three intake towers, each of which will serve two units through a 12-ft. penstock 650 ft. long.

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## Decision Pending in "Hand-Picked" Case

At long last Federal Judge Julian W. Mack, sitting in the "hand-picked case" to test the Public Utility Holding Company case, heard oral arguments of the S.E.C. attorneys and of counsel for Electric Bond & Share Company. The oral arguments opened on Armistice Day and required only two days.

Progress of the case has seemed tortuous, as at first the S.E.C. attorneys took the position that the hand-picked case would decide the major points at issue in other Holding Company Act cases. In this other companies disagreed, notably North American and American Water Works, which have appeared before the Supreme Court asking that their test cases be allowed to proceed in the regular way.

Subsequently, S.E.C. attorneys concluded that Federal Judge Mack should pass only on the registration provisions of the act.

In oral arguments counsel for Bond & Share maintained the registration provision could not be passed on separately from the rest of the act. The point at issue was not merely registration, said Judge Thomas D. Thatcher, but the constitutionality of the entire Public Utility Holding Company Act.

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## Colorado Withdraws Power Plants Protest

Colorado has withdrawn its protest to development of hydro-electric plants along the All-American canal in the Imperial Valley, subject to certain provisions for the conservation of Colorado River water, according to an announcement made by Gov. E. D. Johnson and Attorney-General Byron G. Rogers.

A letter sent to Secretary of the Interior Ickes withdrawing opposition to a proposed P.W.A. loan to California interests for power development stipulated that the Pilot Knob plant is still opposed by Colorado, and that objections are made to any plan to permit waste waters from the electric plants to flow into Mexico.

# Stone & Webster Announces New Construction Costing $11,000,000

**Two public utilities, large railway company to add generating capacity — Several industrials and utilities discussing additions**

Contracts for eleven million dollars of new construction jobs were announced this week by James H. Manning, president Stone & Webster Engineering Corporation. Seven and a half million dollars will be expended on power plant construction.

Largest single item is the $4,350,000 addition for Williamsburgh Power Plant Corporation, principal source of power for Brooklyn-Manhattan Transit System. Stone & Webster will design and manage the construction of the addition.

Equipment, to be superposed, includes two 25,000-hp. turbine-generators, two coal-fired boilers, capacity of each, 575,000 lb. of steam per hour.

Two contracts from public utility companies have been received, Mr. Manning said, aggregating $3,200,000. These are for design and construction of generating stations, but the companies preferred that details be withheld for the present.

Brunswick Pulp & Paper Company has contracted with the Engineering Company for its services in the construction of a $3,500,000 bleached sulphate pulp mill.

The Engineering Company, it was said, is currently discussing additional construction with a number of the nation's major industrial and public utility companies.

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## Utility Opposes West Virginia Dam

Construction of the Bluestone Dam, near Hinton, W. Va., has been delayed indefinitely as the result of the filing of a demurrer by the West Virginia Power Company in regard to the condemnation of lands for the dam site. The demurrer was sustained by District Judge George W. McClinic at Charleston.

Land on which the dam is to be located is owned by the West Virginia Power Company, which filed the demurrer to the condemnation proceedings on the grounds that Congress does not have the power to delegate to the President the authority to acquire such property. Chief counsel for the power company is Newton D. Baker, Cleveland, Ohio, former Secretary of War.

Bluestone reservoir dam is to be equipped with facilities for the generation of electric power.

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## Rail Electrification on Drafting Tables

Formal announcement by the Pennsylvania Railroad is expected soon of plans now on drafting tables to extend electrified lines from Paoli (just outside Philadelphia) to Harrisburg, a distance of 84 miles. Less definite are plans to electrify lines between Harrisburg and Baltimore, but such a program, *in toto*, is expected to cost $30,000,000 to $40,000,000. This program would be under construction in 1937 and consideration is being given now, it is reported, to electrification of the 245-mile stretch from Harrisburg to Pittsburgh.

Only last year, on February 10, the Pennsylvania Railroad completed elec-

**SIGNS ON THE DOTTED LINE — A few strokes of the pen by Harold L. Ickes, Public Works Administrator, and Arthur E. Allen (left), Westinghouse vice-president in charge of merchandising, had a million-dollar refrigerator order (story in "Electrical World" November 7, 1936, Page 67)**

trification of the 226-mile stretch between New York and Washington at an expenditure of more than $100,000,000 and embracing 1,405 miles of track. This line is computed to use 700,000,000 kw.-hr. per year under normal service of 686 trains daily.

To provide complete flexibility and reduce new capital requirements, it is said GG-1 locomotives would be used on the new system, releasing steam locomotives needed on other divisions. This implies that the new extensions would include 132-kv. transmission, 11-kv. trolley service and standard beam-type bridges, cross-catenary construction with the usual assortment of messengers, auxiliaries, spans, hangers and transposition arms.

Daniel Willard, president Baltimore & Ohio Railroad, revealed that two 3,600-hp. Diesel-electric locomotives have been ordered for the Washington-Chicago run. Running time between the cities will be reduced 60 to 90 minutes, Mr. Willard said, because the engines will run the entire distance without operating stops.

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## High-Voltage Plans Enlarged at M.I.T.

Among the items planned in the expansion program of Massachusetts Institute of Technology announced by President Karl T. Compton is one for $340,000 for high-voltage laboratory equipment. Also budgeted is $50,000 per year for operations in the high-voltage laboratory.

# Says President Deplores Popular Concern Over T.V.A. Power Issue

**Chairman Morgan of T.V.A. says President feels power issue obscures main objects — Sees clearer outlook for co-operative pooling — Markets for power the big question facing government**

*Special to* ELECTRICAL WORLD

"The President wants to make power an element in the program," Dr. A. E. Morgan, chairman Tennessee Valley Authority, told newshawks at the close of his latest conference with President Roosevelt, "for a unified development of all these projects." Dr. Morgan was referring to soil erosion, natural resources conservation, population and reforestation.

"He wants the main purpose to be more clearly identified and followed," added Dr. Morgan, "and does not want popular concern over power to run away with the main purpose.

"He stated that power use had more or less obscured the whole issue."

Those close to the Washington scene place great weight upon the fact that Dr. Morgan was asked to discuss T.V.A.'s future with the President as the doctor's sensible and direct respect for facts is well known.

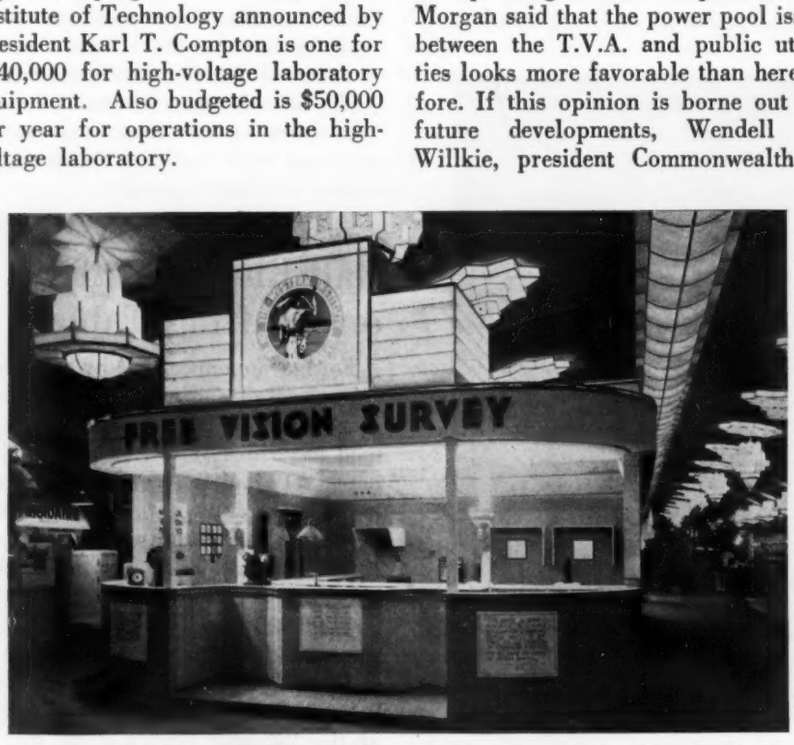
Expressing his own opinion, Dr. Morgan said that the power pool issue between the T.V.A. and public utilities looks more favorable than heretofore. If this opinion is borne out by future developments, Wendell L. Willkie, president Commonwealth & Southern, may develop into the public utility hero of the hour for the patience and foresight exhibited in transmission pool conferences.

### *Power markets again*

The feeling is gradually assuming increasing weight that P.W.A. has given away almost all the money it can to cities and towns which wish to construct competing electric plants. This economic condition will stand, it is said, regardless of the Supreme Court decision in the Duke Power case. Thus, where the government will sell its incidental power again becomes even more a major question.

"We need a national power policy," said Dr. Morgan (and this he said was discussed with the President) "which should provide that every major contract for power should go to some central government agency for approval."

This is necessary, said Dr. Morgan, because the government might get into the position where Boulder Dam, Bonneville and Grand Coulee would be bidding against each other or against T.V.A., endeavoring to market power unless a general clearing house, by inference Federal Power Commission, was established to control contract developments.




**BETTER SIGHT — BETTER LIGHT — A free test of visual acuity, judgment of distance, binocular co-ordination, visual field and color vision were given to all visitors to the Los Angeles County Fair by registered optometrists. Moral: for better sight, better light**

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## British Grid to Add 120,000 Kw.

To meet the rapidly increasing demand for electricity in the South-East England area an electric power station, estimated to cost between £2,000,000 and £3,000,000, is to be constructed in Kent by the Kent Electric Power Company as part of the grid system, reports a recent issue of *Electrical Foreign Trade Notes.*

The first section of this station, comprising the initial 120,000 kw. of the contemplated plant, will probably consist of one 60,000-kw. and two 30,000-kw. turbo-alternators and six boilers, each of an evaporative capacity of 256,000 lb. per hour.

# N.A.R.U.C. Convention Approves New Utilities Accounting System

**Federal Commissioner proposes amendment to judicial code fixing original cost as basis for rate regulation— Will co-operate with F.P.C.**

Considerable refinement in electric utility accounting is foreshadowed by the adoption of a new uniform system of accounts by the National Association of Railroad and Utilities Commissioners in Atlantic City last week. Transmission plant is more thoroughly segregated from distribution and the operating expense classifications are modernized and made more nearly functional; common utility plant, depreciation expense, merchandising and ascertainment of original cost are left flexible to meet the needs of local situations. In fact, as the resolution for adoption emerged from the executive committee it carried the compromise clause "recommended . . . for adoption . . . with such modifications only as they may deem necessary in the public interest."

Even with this middle-course commitment there was sentiment in the discussion in favor of an additional year of consideration before adoption. Some of the hesitancy was based on the fear the cost of conducting the new system would exceed the benefits derived from a full disclosure of transactions. Hoch of Kansas said candidly that the code would be rejected in the public interest if it occasioned inordinate costs to get facts of only academic interest. In the voting on the adoption Pennsylvania and Louisiana refrained because of pending cases. One argument that seemed to swing the favorable action on the system was that it offers the means to avert double accounts for companies that are conforming to the old (1922) system of N.A.R.U.C. and the new Federal Power Commission accounting which the new uniform state rules closely resemble.

Definite procedure was approved for co-operative action with the Federal Power Commission for conferences, hearings and joint board functioning. Before this action was taken, however, there was a mixed sentiment of fear and satisfaction about the Federal Power Commission—fear of inevitable absorption of state powers in spite of the present limitation in the power law and satisfaction with the complementary services afforded in getting at intercompany transactions. In detailing his concept of co-operative action Commission Attorney Collins of Connecticut asserted that state rights would be preserved if the states should yield to federal procedure only when interstate factors dominate the proceedings.

Proposal for clarifying modification of the judicial code was offered by Federal Power Commissioner Seavey in his argument for original-cost rate bases. His proposal to fix this for the courts and thus remove the courts from the reproduction-new dilemma is that where rates give a fair return upon historical or original cost the evidence supporting such finding shall constitute *prima facie* proof that the rates are just and reasonable. A second proposal of his is that no rate order shall be set aside, enjoined, suspended or restrained upon constitutional grounds unless the court finds the rates confiscatory. Convention sentiment favored the proposals, although some doubted their efficacy for shunting reproduction cost aside.

Commissioner Thomas E. McKay of Utah was elected president of the association for the ensuing year. The Securities and Exchange Commission was voted into membership.

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## Cities to Ask Voice in Pooling Parleys

A "protect-the-consumer" organization composed of representatives of more than 150 municipalities interested in Tennessee Valley Authority power will be promoted at a conference in Chattanooga, December 2, Col. H. C. Fiske, chairman Chattanooga Electric Power Board, announced.

The organization plan, Col. Fiske explained, was the "outgrowth of current power pool negotiations. We decided to sponsor such an organization after a conference with Tennessee Valley Authority officials in Knoxville a month ago," he declared. "It was apparent the consumer needed representation.

"We are not antagonistic either to the private utilities or the TVA. We are interested in getting the facts.

"This thing should be a three-way proposition—that is, private power

**WELCOME TO N.A.R.U.C. — The boys turned around for a picture just after Governor Harold H. Hoffman of New Jersey (third from left on platform) had welcomed National Association of Railroad and Utilities Commissioners to their Atlantic City convention**

companies, T.V.A. and the consumer. Previously the discussions have been two-way affairs, just the power companies and T.V.A."

Col. Fiske added that after an organization is formed it would probably request that it be represented at future power pool conferences.

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## Wisconsin Utilities Association Meets

In his opening address at the recent convention of the Wisconsin Utilities Association, held in Milwaukee, F. A. Coffin, president of the association, suggested the theme of the program, when he clearly stated the problems facing the utilities in that state and told of the efforts being made toward effecting their solution. Following speakers discussed sale of electric hot water heaters, national advertising for power sales, new classification of accounts required by the Federal Power Commission and rural electrification. The convention, staged jointly by the commercial and technical sections, featured exhibits by manufacturers.

Electric water heaters can't be sold against gas and other competitive heaters on the basis of cost comparison, but they can be sold, and in large numbers, on their merits of service and convenience, declared K. M. Robinson of the Idaho Power Company. Referring to the carrier-control system recently installed by his company, Mr. Robinson said that, in his opinion, such control would be justified for any group of 400 or more water heaters served out of one substation. W. H. Hodge of the Utilities Service & Engineering Corporation presented a convincing argument for the use of adequate modern sales methods in holding and enlarging the industrial power load. National advertising, said Mr. Hodge, is a tool for power sales that should be used.

According to C. E. Kohlhepp of the Wisconsin Public Service Corporation, utilities engaged in the transmission of electric energy in interstate commerce are going to be considerably confused in their bookkeeping after the first of the year because of the ruling of the Federal Power Commission requiring books to be kept in the new classification of accounts approved by the Association of Railroad and Utilities Commissioners. This confusion will result from the fact that many such utilities will have to continue present methods of accounting required by their state commissions, and thus two sets of books will have to be kept, Mr. Kohlhepp explained.

Ralph Moody of the Wisconsin Gas & Electric Company gave a lucid description of the acceleration of rural electrification in eastern Wisconsin by the companies with which he is associated. He emphasized as a fact that the program of farm line building these companies undertook had started before the R.E.A. was organized and said that the claims of the political rural electrification evangelists for credit for having awakened the utilities from slumber were baseless in this instance, at least.

In the parallel sessions of the commercial and engineering sections a number of interesting papers on various subjects were presented. Sales training and market analysis, home service, lighting in its industrial, commercial and domestic aspects and range and hot water heater sales engaged the attention of the commercial group. The engineers discussed methods of making service rules more practical, meter developments, application of capacitors, radio interference, lightning protection, operating experiences of modern generating stations and rural line transformers.

## *Meetings*

**American Society of Mechanical Engineers** — Annual meeting, New York, N. Y., November 30–December 4. C. E. Davies, national secretary, 29 West 39th Street, New York, N. Y.

**National Exposition of Power and Mechanical Engineering** — Grand Central Palace, New York, N. Y., November 30–December 4.

**American Society of Agricultural Engineers**—Winter meeting, Hotel Stevens, Chicago, Ill., November 30-December 4.

**Society for the Promotion of Engineering Education**—Fall meeting, Middle Atlantic section, Columbia University, New York, December 5. A. Dexter Hinckley, assistant to the Dean, School of Engineering, Columbia University, New York, N. Y.

**American Engineering Council**—Annual meeting, Mayflower Hotel, Washington, D. C., January 14-16. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

**American Institute of Electrical Engineers**—Winter convention, New York, N. Y., January 25-29. H. H. Henline, national secretary, 33 West 39th Street, New York, N. Y.

## E.E.I. Equipment Group Holds Meeting

The fall meeting of the electrical equipment committee of the Edison Electric Institute was held recently at Rochester, N. Y. The organization of the committee, which has proved so successful during the past few years, is being continued, with minor modifications which experience has shown to be desirable. The committee has four divisions under separate division chairmen: Apparatus and design division, H. L. Wallau, chairman; meter and service division, A. E. Silver, chairman; operation and maintenance, E. S. Fields, chairman, and system planning, S. M. Dean, chairman. In addition the committee organization includes a group headed by A. H. Lawton and consisting of the officers of the committee, as a foreign practice group.

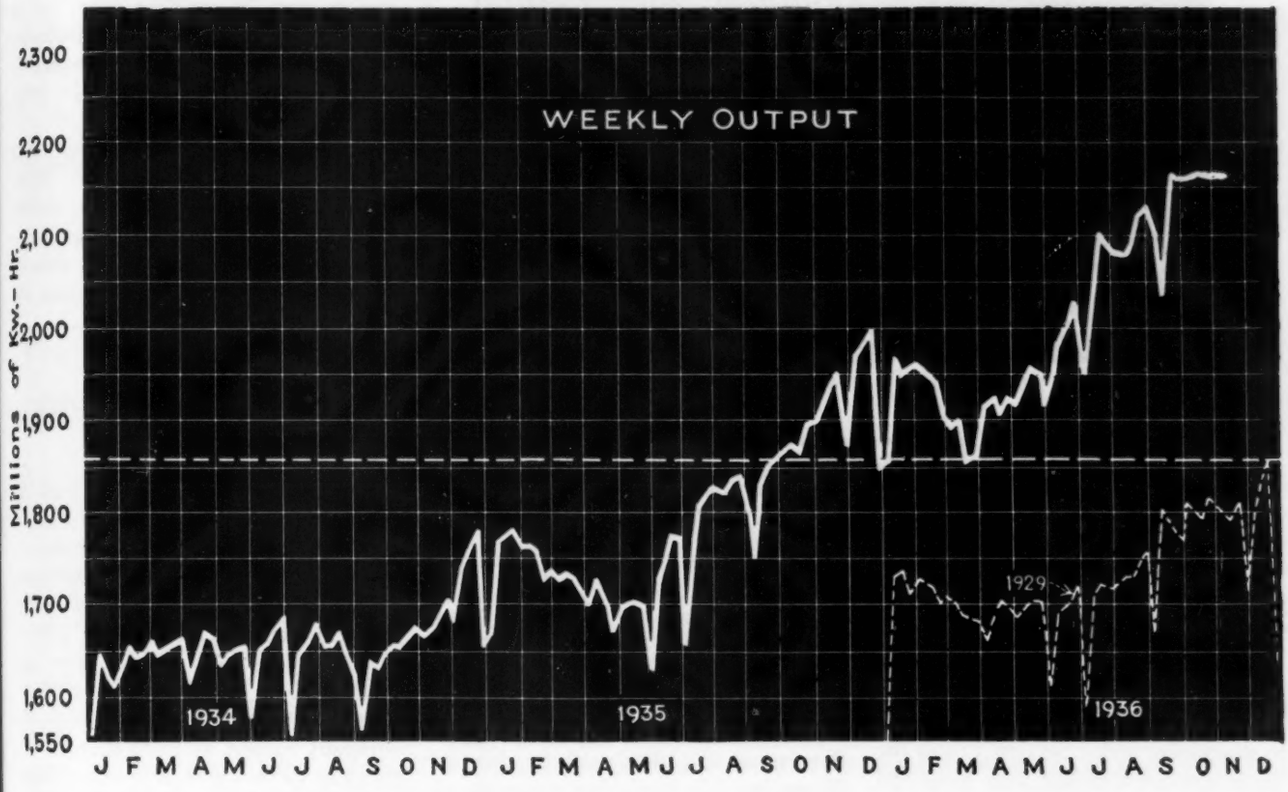
Considerable progress is being made on the preparation of standards for oil circuit breakers. A.I.E.E. Standard No. 19A was published in July, 1936, and is available from the A.I.E.E. headquarters. Also the A.I.E.E. Standards for Fuses above 600 volts was published last July. The specifications for outdoor oil circuit breakers 15 kv. and above has been approved by the A.E.I.C. committee on electric switching and switchgear and has been referred to the E.E.I.-A.E.I.C.-N.E.M.A joint committee for general discussion, revision and approval.

The problem connected with the possibility of fires from insulating oils is continuing to receive attention from the committee. The Philadelphia Electric Company recently made extensive tests of the effectiveness of various methods of combating insulating oil fires. A colored moving picture of these tests was presented.

Increase in the use of flash welders is presenting a number of problems in connection with the rendering of satisfactory supply service. The committee is planning to study this problem looking towards co-operation with the manufacturers to see that the over-all economics of the supply and operation of the equipment are taken into consideration so as to obtain satisfactory and economical operation.

An interesting paper on system modernization was presented by Mr. Greene of the Detroit Edison Company.

# Output Steady For Nine Weeks




For the ninth consecutive week the production of energy in central stations for electric light and power remains at the level attained in mid-September. In the week ended November 14 it amounted to 2,169,715,000 kw.-hr., the Edison Electric Institute announces.

During the corresponding period of 1935 there was a strong rise. As a consequence of this dissimilarity in the two years the current excess over 1935, which two months ago was 17.2 per cent, has narrowed to 11.9 per cent. The present movement, or rather lack of movement, closely resembles the pattern of 1929, and production continues to be about 21 per cent ahead of that year. Since lighting increases in autumn some recession is indicated in the industrial load.

**Weekly Output, Millions of Kw.-Hr.**

| 1936 | 1935 | 1934 |
|---|---|---|
| Nov. 14..2,170 | Nov. 16..1,939 | Nov. 17..1,691 |
| Nov. 7..2,169 | Nov. 9..1,914 | Nov. 10..1,676 |
| Oct. 31..2,176 | Nov. 2..1,897 | Nov. 3..1,669 |
| Oct. 24..2,167 | Oct. 26..1,896 | Oct. 27..1,677 |
| Oct. 17..2,170 | Oct. 19..1,863 | Oct. 20..1,668 |
| Oct. 10..2,168 | Oct. 12..1,867 | Oct. 13..1,657 |

**Per Cent Change from Previous Year**

| Region | Week ended Nov. 14 | Nov. 7 | Oct. 31 |
|---|---|---|---|
| New England | + 8.3 | + 9.9 | + 9.7 |
| Middle Atlantic | +11.6 | +12.7 | +13.1 |
| Central Industrial | +13.8 | +17.2 | +18.4 |
| West Central | + 8.3 | +10.7 | +11.4 |
| Southern States | +18.0 | +17.2 | +20.1 |
| Rocky Mountain | +16.0 | +19.3 | +18.6 |
| Pacific | + 6.5 | + 4.5 | + 7.2 |
| United States | +11.9 | +13.4 | +14.7 |

## Northwest Utilities Transfer Control

Transfer to the Citizens Utilities Corporation of Delaware of public utilities which serve a score of small communities in Spokane and Stevens Counties was shown in papers filed in Spokane recently with County Auditor Frank Glover. The utilities concerned were once identified with the Foshay interests. The papers which were filed indicated the Citizens Corporation was assuming obligations, taking title to properties which are covered by a $4,627,000 bond issue.

Citizens Utilities Corporation is an outgrowth of the Public Utilities Consolidated Corporation which took over numerous Foshay properties several years ago. Some of the communities affected by the transfer are Deer Park, Milan, Chattaroy, Colbert, Denison, Green Bluff, Springdale, Valley, Grays, Loon Lake and Clayton.

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## Associated Suit Adjourned; Hearing Set for January

Proposed settlement out of court of the two-year legal battle between the Associated Gas & Electric Company and the group of creditors who demanded its reorganization drew nearer last week when Federal Judge Julian W. Mack granted a two-month adjournment asked by each side. The adjournment until January 8 is in line with a stipulation filed recently with the court which provides for the operation of the company for the next 60 days under the control of representatives of both sides.

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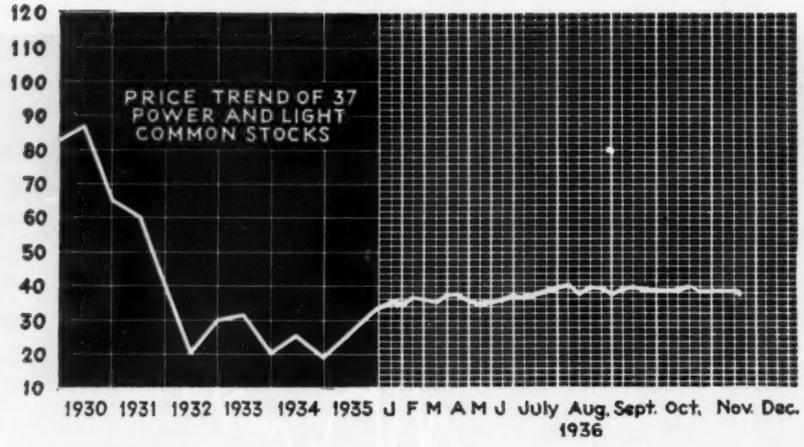
## N. Y. Utility Permitted to Transmit Energy

Federal Power Commission has announced that permission has been granted the New York State Electric & Gas Corporation to transmit electric energy from New York State to the Canadian Customs at Hemingford in Huntington County, Province of Quebec, Canada. Under the terms of the application, which was filed in September, less than 1,000,000 kw.-hr. annually at scheduled tariff rates is to be transmitted.

## Utility Stocks Drift Lower




**Stocks of electric light and power companies moved within a narrow range this week. Losses were sufficient, however, to carry the "Electrical World" index down to 37.1; last week, 38.3**

## Court Denies Plea for Reorganization

Federal Judge Samuel Mandelbaum has refused to permit the bankrupt National Public Service Corporation to reorganize under Section 77b of the Bankruptcy Act as had been proposed by Associated Gas & Electric interests, which are creditors. An appeal to the Circuit Court is planned.

In his opinion Judge Mandelbaum upheld the finding of Irwin Kurtz, special master, who had said there was "nothing to reorganize" (November 14, page 16). The court and the master concurred in the opinion that National Public Service had completely lost title to 712,411 shares of common stock of the Jersey Central Power & Light Company, which had been pledged as security for a debenture issue. Judge Mandelbaum held that this collateral stock was now the property of creditors. It is scheduled to be sold at public auction on November 24.

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## Large Bond Issues Filed with S.E.C.

A registration statement covering issues aggregating $44,500,000 was filed last week with S.E.C. by the Oklahoma Gas & Electric Company. The issues will be $35,000,000 of first mortgage 3¾ per cent bonds, and $9,500,000 of 4 per cent debentures. Consumers Power Company also filed with the S.E.C. a statement for $12,000,000 of first mortgage 3¼ per cent bonds.

First mortgage, series A, 3¼ per cent bonds of the New England Power Company of a principal amount of $10,067,000 were offered last week at 103.50. The bonds, which are dated November 15, 1936, will be due on November 15, 1961. Net proceeds of the issue, together with an additional amount estimated at $356,584, to be supplied by the company, are to be used for the redemption on January 1, next, of all of the outstanding $10,067,000 of first mortgage 5 per cent sinking fund bonds of the company due July 1, 1951, at a price of 105.

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## New Merger Rules by N. Y. Commission

Plans for mergers submitted to Public Service Commission of New York by Consolidated Edison, Niagara Hudson and Associated Gas & Electric have led the commission to issue a new set of rules, regulations and principles under which such mergers may be consummated.

Companies have stated they are consolidating to eliminate unnecessary intermediate companies, simplify corporate structures, enlarge co-operating units, reduce taxes and reduce cost of service.

Commission statement stressed the regulatory complications which might be introduced by the enlarged size of the units, announced that "a very large part of the economies effected by unification" should inure to "the public," and that no permission would be granted for mergers unless the companies offer "affirmative proof" of the advantages to the public, including "estimates of savings in operating costs and any investments in property."

Fourteen specific requirements were laid down to govern mergers. These related to logical integration, strictly intrastate operations, continuing property records, original cost records, surrender of duplicate franchises, etc.

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## New Low Financing Rate Established

Utility treasurers' eyes this week are being treated to the sight of a $3,000,000 utility bond issue being taken on what amounts to a flat 3 per cent basis. The issuer is Turners Falls Power & Electric Company, formed in 1792 to operate locks and canals, now controlled by Western Massachusetts Companies and, more pertinently, the company earned its fixed charges 8.38 times in 1935. The award was to Guaranty Trust Company of New York on a bid for 30-year 3¼s on a 3 per cent interest cost basis. Tenders were asked for 20-year 3s, for 25-year 3⅛s or for 30-year 3¼s and the company accepted the longest term.

This is probably the lowest rate at which public utility bond financing ever has been provided. It is vivid evidence of the advantages which accrue to a soundly financed public utility when it is not subjected to punitive taxation and political competition.

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### Employee Group Files $25,000,000 Issue

The G. E. Employees Securities Corporation of Jersey City has filed a registration statement with the S.E.C. covering $25,000,000 of 5 per cent voting debenture bonds. The securities are to be issued serially under an indenture, dated September 29, 1936, and to mature on December 1 of the tenth year from the year of issue.

Entire proceeds will be available for investment by the corporation. The bonds will be sold only to persons who have been connected with the General Electric Company a year or more.

# Manufacturing AND MARKETS

## Will Try to Disintegrate the Atom With Electrostatic Generator

**Westinghouse researchers will study the production and control of high voltages with large, bulb-shaped, high-pressure vessel**

To gain information as to the production and control of high voltages —of increasing importance in the field of nuclear transmutations—the Westinghouse Electric & Manufacturing Company is building, at its research laboratories in East Pittsburgh, an electrostatic generator designed to reach d.c. potentials of 5,000,000 volts or more, according to an announcement by M. W. Smith, manager of engineering. The steady attaining of such voltages—several million volts higher than any reached in the past—will enable the research scientist to secure fundamental information in this relatively unexplored field.

A large high-pressure vessel, shaped somewhat like an incandescent light bulb, will be used to secure the high voltages. The vessel, mounted on the roof of a two-story laboratory building, is 47 ft. high; the upper, hemispherical part has a diameter of 30 ft. In the center of the upper end of the tank will be mounted a 15-ft. spherical electrode, with which it will be possible to maintain steady potentials of 5,000,000 volts or over, using air under pressures up to 120 lb. per square inch. (The voltages will be reached by using charged rubber belts in the modernized Van de Graaf version of an electrostatic machine.) The electrode is supported by four large micarta insulating columns and connected to the lower ground end of the vessel by means of a segmented porcelain vacuum tube, which contains the lens electrodes to focus the nuclear projectiles onto the desired targets. These nuclear projectiles—protons, deuterons and alpha particles—are formed at the high potential electrode and finally focused onto a small target spot about 35 ft. away from the point of formation of the bombarding ions.

Westinghouse scientists plan to use this high-voltage generator in investigations of nuclear reactions throughout the range of voltages available, it being believed that the steady nuclear beams of homogeneous energy, necessary in these investigations in nuclear physics, are most readily attainable through the projected design of high-voltage equipment.

The work will be under the general supervision of Dr. L. W. Chubb, director of the Westinghouse Research Laboratories; Dr. William H. Wells is in direct charge of the project, including design and construction of equipment. Dr. Wells is a graduate of Amherst, received his graduate doctorate degree from Johns Hopkins University and, prior to joining Westinghouse last June, was associated with the Physics Laboratory of the University of Minnesota.

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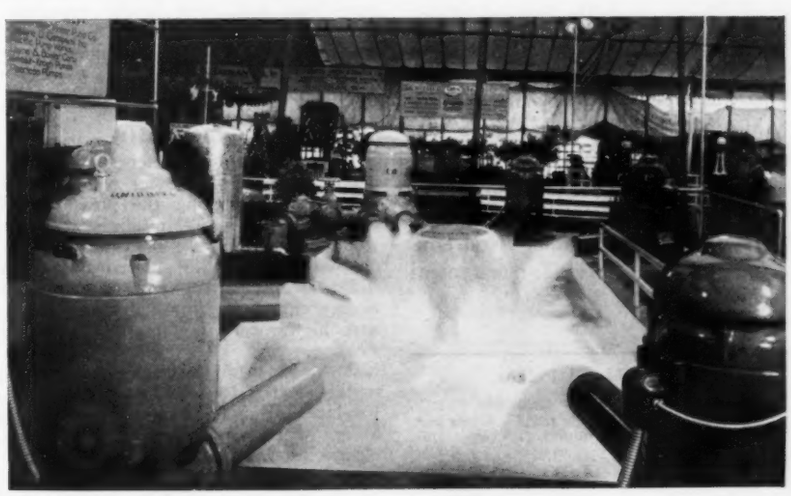
## Housewares Week Plan Launched

Many electrical housewares merchandisers participating in the Second National Electrical Housewares Week, a co-operative drive to capitalize the Christmas gift market sponsored by Edison Electric Institute and twelve large electrical manufacturers during the week of December 7–12, will promote sales of matched appliances.

Electrical dealers realizing the tre-



**PUMPING AT POMONA — With a submersible pump operating in the center, turbine type pumps on the sides, Southern California Edison demonstrates pumping on the farm at the Los Angeles County Farm**

mendous eye appeal and display value of new, modern, style-matched electric table cooking equipment will install special window and interior displays featuring these appliances. Housewares merchants are also planning demonstrations to promote the use of matched ensembles at buffet luncheons, bridge parties, teas and the like. In addition to featuring the beauty of electrical tablewares at these occasions, the ease and simplicity of electrical entertaining will be emphasized.

Other dealers will direct sales efforts toward marketing the smart, convenient snack servers which have recently become popular with host and hostess alike. Holiday promotions will be staged to interest Christmas shoppers in giving beautiful hospitality sets or electrical housewares combination units such as glass coffee maker and toaster or waffle baker and percolator. All electrical housewares retailers are tying-in holiday promotional activities with Second National Electrical Housewares Week, thereby securing full benefits to be derived from co-operating in a timely, nation-wide merchandising event directed at what promises to be one of the richest Christmas markets in years.

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## Power Exposition to Present New Products

Power men soon will meet many old friends in operating equipment dressed up in their new 1937 improvements and gathered on three floors of Grand Central Palace, New York, at the Twelfth National Exposition of Power and Mechanical Engineering, opening in New York a week from Monday.

Two hundred and sixty-two exhibitors have marshalled their best and newest for display to visitors from utility companies, electrical manufacturers, heating and ventilating companies, iron and steel plants, from construction, transportation, mechanical and chemical fields.

**New York Metal Prices**

| | Nov. 10, 1936 Cents per Pound | Nov. 18 1936 Cents per Pound |
|---|---|---|
| Copper electrolytic | 10 50* | 10.50* |
| Lead Am. S. & R. price | 5.00 | 5.20 |
| Antimony | 12 25 | 12.25 |
| Nickel ingot | 35.00 | 35.00 |
| Zinc spot | 5.325 | 5.425 |
| Tin Straits | 53 50 | 51.625 |
| Aluminum, 99 per cent | 19—21 | 19—21 |

* Delivered Connecticut Valley.

# Field Reports on Business

*Flow of extra dividend payments, wage increases and bonuses continued this week, insuring larger purchasing power for the Christmas season than in any year since 1929. Leading steel manufacturers will increase prices for finished steel products, effective January 1. October world copper consumption of 172,423 tons set a new top for two years; stocks were at new low of 356,780 tons, or approximately two months supply.*

### NEW ENGLAND

The contract for a hydro-electric plant on the Lamoille River, Milton, Vt., has been awarded and orders placed for a 3,750-kva., 2,300-volt. generator and a Kaplan type turbine working under a 41-ft. head. Small motor sales continue to forge ahead in this district; fractional-horsepower motor orders are heavy in anticipation of strong upward trends ahead in merchandising; one prominent manufacturer reports approximately 2,000 small fractional-horsepower motors are being sold weekly, most of which are going into appliances and devices made in this district.

Central station equipment orders are spotty; one representative recently sold insulators, and pole-line hardware, for a 12-mile transmission line in southern Maine; some rush orders for poles and crossarms have been filled by another prominent distributor. Illumination is very active in this area. More than 100 250-watt sodium street lights have been bought by Chicopee, Mass.; a college athletic field in Boston has installed six floodlights. Service station lighting is moving ahead; orders were placed a short time ago for fourteen of these units.

Interior electric lighting is receiving much attention. The city of Boston is advertising for lamps amounting to about $8,000 for school use and will soon purchase for general supply lamps at a cost of approximately $12,000.

Among the numerous electrical applications in demand now in this district are noted electric counter cooking equipment which will soon be purchased for two new large roadside restaurants, new X-ray apparatus and control equipment for the Boston city hospital and electric cooking equipment for two eastern Massachusetts schools.

The Fore River plant of the Bethlehem Steel Company is planning for an unusually busy year with very bright prospects for considerable work ahead on merchant ships in addition to a heavy government program. This announcement presages a good demand for electrical equipment.

### CHICAGO

Wholesalers and retailers enjoyed an exceptionally active week as trade picked up sharply. Anticipating the greatest holiday trade in many years, retailers are pressing wholesalers to supply their needs. The increased demand for electrical appliances indicates heavy year end sales. Electrical energy output for this district established a new high record for the third consecutive week.

Construction of a million-dollar addition to the electrical generating facilities of the Produce Terminal Corporation has begun in order to meet the expanding demand of electricity in the Central Manufacturing district. The addition will house two 12,500-hp. boilers and a 7,500-kw. turbine. Orders for central station supplies are steadily increasing and all indications point to greatly increased expenditures by utilities next year. One manufacturer reports a large order for transformers. Another reports heavy orders for wire and cable from steel mills. The demand for motors and control apparatus remains encouraging.

Expanding activity in the railroad shops has brought a flood of orders and inquiries for additional electrical equipment. Several lamp manufacturers are working at capacity and have a number of unfilled orders. One manufacturer of Christmas lighting equipment reports the largest volume of orders in its history.

### NEW YORK

Indications seem to point to expansion of the buying movement in steel even during December when ordinarily a seasonal decline occurs. Large-scale buying on the part of the railroads is in evidence and the automotive industry promises to be an outstanding factor in steel activity. The weekly output of the automotive industry is now estimated at 100,000 units.

Production of electricity by the electric light and power industry of the United States for the week ended November 14 was 2,169,715,000 kw.-hr., according to the Edison Electric Institute, an increase of 11.9 per cent over 1935.

Retail trade volume throughout the country last week rose from 15 to 25 per cent over the 1935 period.

### PACIFIC COAST

Executive refusal to mediate the shipping strike at this time has postponed the general expectation of an early settlement and higher electrical prices along the coast are sure to result from rail shipments and consequently higher freights. All steel products are advancing on approximately a 10 per cent front and light and heavy wall conduit are affected immediately.

Rubber- and lead-covered wires advanced nearly as much due to their raw material markets, though weatherproof wire's surprising half-cent drop may neutralize recent heavy orders in expectation of raise.

Manufacturers and wholesalers report rapidly depleting stocks. Recent renewed activity by engineers is reflected in excellent sales of plant material such as fuses, insulating specialties and safety switches. Bay Bridge revenue on its opening day amounted to $55,000 and that rate has been nearly maintained.

Completion of San Francisco's exposition island site is scheduled for early 1937, almost coincident with submission of approved plans for its exterior lighting by General Electric, holder of award. Bids for palace wiring and interior lighting may possibly be called for before January.

Movie theaters form an increasing factor both for building and renovation. 30 Loew houses alone replacing their sound systems. Schools have dropped to small scattered structures averaging $80,000 each and government postoffices averaging $250,000 each for Hilo, Hawaii, Sitka, Alaska, and Salem, Ore., are the largest federal structures announced.

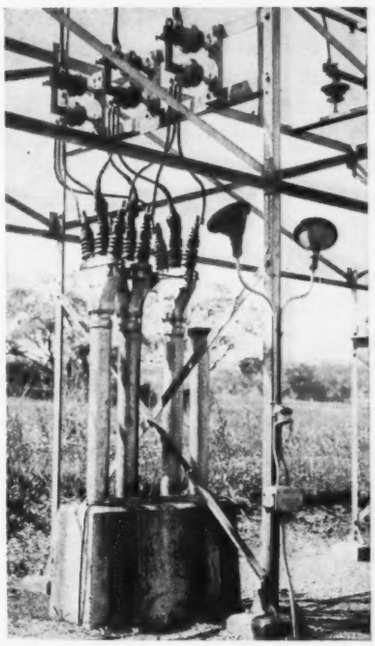
# Field OPERATING PRACTICES

*New ideas and practices in the operation of well-designed, constructed and maintained plants and systems*

## Using Rigid Conduit Flexibly Outdoors

How effective rigid conduit may be as a tool in outdoor substation construction is shown in the accompanying view of a wiring detail made at Menands, N. Y., on the Niagara-Hudson system. In this situation it was necessary to run a feeder circuit underground to disconnecting switches mounted on an overhead steel structure, and to provide floodlighting for switch and overhead bus inspection without introducing hazards to operators on the ground by using open conductors or by taking up space in the yard which good operating practice requires be left as free of obstructions as possible. The circuit capacity was too large to make it convenient to employ a single three-phase underground cable in leading to the disconnects from below and it was desirable to minimize the use of auxiliary supporting parts in equipping the arbor bays, both for power and floodlighting connections.

Flexibility was increased by running three three-phase underground cables to the overhead structure, so that if trouble develops on one cable, two others may still be utilized, isolating the section in need of repairs and providing for a period of operation at subnormal load rather than on open circuit. The conduit risers are sufficiently rigid to require no extra bracing or other heavy supports than the concrete pedestal settings through which they pass. Cable potheads are mounted well above the operator's head and near enough to the disconnect terminals to require only a few feet of open cable taps between the bushing terminals and switches. The arrangement is so compact and firm that ample space exists for the passage of the arbor cross-bracing between risers in mechanically tying together the steel columns of the overhead structure. The floodlights, of weather proof design, are compactly mounted on a double-stemmed Y riser clipped to the arbor column and requiring no other support at the top. Switch, fuse box and portable plug connections are all made from these small risers with minimum encroachment on yard space and only the bare necessities of material.



**Necessity for space economy and operating safety in an outdoor substation resulted in this compact, flexible conduit installation**

Grounding connections between the feeder riser conduits and the earth are made by cross-bar connections between the potheads at the top of the cable run, with a stranded copper vertical tap tied into a structural steel horizontal cross-bar at the bottom of the pipe run, which in turn is tied into the earth by a short run over the surface of the concrete pedestal. The clearances thus secured contribute to maximum safety of operation besides economizing in the use of material for the several functions described.

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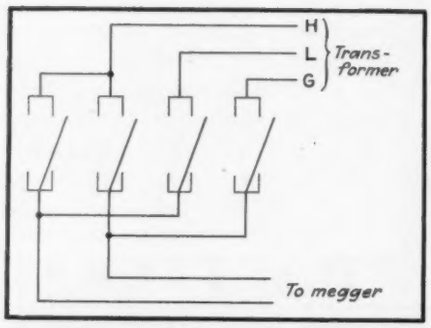
## Checking Insulation of Transformers

When transformers are brought into the central repair shop of one statewide utility the insulation resistances between high and low, high and ground and low and ground are "meggered" and oil samples taken. If the Megger readings on primary transformers do not come up to the values given in the table it indicates where attention must be directed. However, oil testing below 25,000 volts may distort the readings and is drawn off and filtered. When the core is untanked search is made for copper pellets and disrupted or roasted coils, the latter being sounded for burned-out sections. Fused or loose leads

**Minimum Allowable Megger Readings for Primary Transformers**

| Voltage Rating (Kv.) | Temperature of Equipment Tested (Deg. C.) | | | | |
|---|---|---|---|---|---|
| | 20 | 30 | 40 | 50 | 60, up |
| 66 and up | 1,200 | 600 | 300 | 150 | 75 |
| 22–44 | 1,000 | 500 | 250 | 125 | 63 |
| 6.6–19 | 800 | 400 | 200 | 100 | 50 |
| Less than 6.6 | 400 | 200 | 100 | 50 | 25 |




**Four-blade switch permits H-L, H-G and L-G Megger tests while drying**

and terminals are also evident from this preliminary examination, which guides the extent of overhauling necessary.

The accompanying allowable minimum Megger readings are given for various temperatures at which the tests are made. A 1,000-volt Megger is used. For example, if a 66/6.6-kv. unit is tested at 20 deg. C and shows H-L and H-G resistances of 1,200 megohms or greater and an L-G resistance of 800 megohms or more, the coil insulation is considered all right. Lower values would warrant drying out the coils and retesting in oil having 25-kv. dielectric strength or greater.

When the coils are being dried or baked the high- and low-tension terminals as well as the core are connected through a four-blade switch to a Megger to permit periodic tests of the H-L, H-G and L-G resistances. Baking is continued until the resistance quits rising and flattens off to a fairly stable value.

Standard ratio and high-potential tests are also made on the units after they have been reassembled, before releasing them for service.

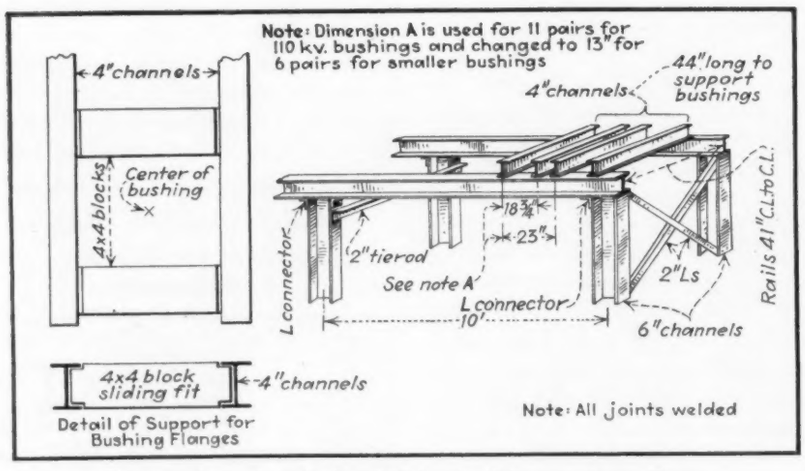
# Compact Storage for 110-Kv. Bushings

Unless convenient, accessible, flexible storage space is provided for all the high-tension bushings that collect in a utility repair shop they will clutter up the shop, may be easily broken and cannot be readily found when needed. This is particularly true because some come from the field in various type of supports and cradles, others arrive from the manufacturers in crates and still others have to be stored while the apparatus to which they belong is undergoing repairs.

A simple but sturdy rack accommodating 34 110-kv. bushings or smaller and occupying a strip of floor space less than 4 ft. wide by 30 ft. long was recently constructed by one utility. The bushings are stored in it in vertical positions so units may be put into or taken out of the rack by the shop crane without disturbing other bushings.

Primarily the rack consists of two 30-ft. steel rails supported horizontally 41 in. apart and 4 ft. 3 in. from the floor on cross-braced 6-in. channel iron columns, all held together by welding. Laid transversely on these rails and welded to them at the separations shown are 44-in. sections of 4-in. I-beams. The flanges of the bushings set on these beams and on short sections of 4 x 4 timber dovetailed between their ends. These blocks are cut for a sliding fit so they may be placed snugly against the bottom of the bushings to prevent their toppling over.

Much floor space that was formerly occupied by crates, cradles and individual or group supports has been released for work space by this rack. It is adaptable to different size bushings, makes them readily accessible and protects them from breakage.




**Construction of rack for 110-kv. bushings and smaller**

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# Standard Cable Sizes in Underground Work

It is impractical for a company operating an underground system to figure out the correct cable size every time an extension or a connection to a new customer is made. The number of sizes kept in stock for such purposes must be reduced to a minimum even at the expense of wasting a few pounds of copper now and then. The following is the standard practice of the Detroit Edison Company:

**Cable—Standard Sizes and Use**

(a) *Standard Sizes*—A complete list of standard sizes of underground cable for all voltage will be found in Section I, Article 2 (of Standard Specifications).

(b) *Use.*

*24,000-Volt Cable*—In general, for use on 24,000-volt transmission trunk and tie lines.

3-conductor cable is used for runs of any considerable length, round or sector, belted or shielded, as specified for the particular job.

1-conductor cable is used for cable pole ends or, in some cases, outdoor substation ends.

Armored cable is used for buried cable.

The aerial cable is used for aerial construction on poles.

1,000,000-circ.-mil and 750,000-circ.-mil cable is used in substations.

350,000-circ. mil and No. 2/0 are standard sizes for transmission trunk and tie lines, either buried or in conduit.

*7,500-Volt Cable*—Is used mostly for street-lighting circuits.

Armored cable is used for buried cable.

*4,800-Volt Cable*—1,500,000-circ.-mil or 1,000,000 and 750,000-circ.-mil, 1-conductor cables are used mostly for substation work.

450,000-circ.-mil and 200,000-circ.-mil are standard sizes for power lines, distribution circuits, tie and trunk lines.

No. 2 is used for branch primary mains and services.

(No. 6, 7,500-volt cable may also be used for this purpose in some cases.)

Armored cable is used for buried cable.

*600-Volt Cable*—Paper-insulated, 1-conductor cable in sizes 200,000 circ.-mil and larger are used for d.c. feeders and mains.

No. 16 paper-insulated cables are used for pressure wires in the d.c. system. The 6-conductor cable is also used for station entrances for telephone lines.

No. 16, paper-insulated, 10- and 25-pair cables are used for aerial telephone lines.

No. 19, paper-insulated, 10- and 25-pair cables are used for underground telephone lines.

Rubber-insulated, 3-conductor cables are used for a.c. services.

The No. 8, 7-conductor coded cable is used for control circuits with loop power lines.

The No. 16, 6-, 12- and 21-conductor cable is used for pressure wires in the d.c. system.

Armored cable is used for buried cable.

# *Locate* FLASHOVERS *within 10 Minutes with this Oscillograph*

FAULTS can be located at once with this oscillograph. There's no need for maintenance men to patrol more than a few towers. By going directly to the fault, they save time and expense.

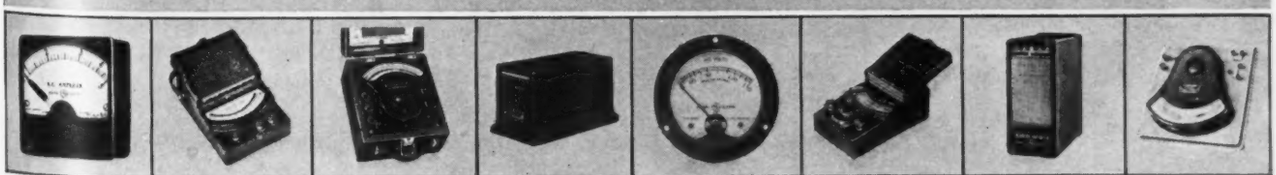
A flashover occurs. One-quarter cycle later the oscillograph starts full-speed recording and continues for the duration of the disturbance. The record can be removed and the distance to the fault accurately determined in five to ten minutes. The facts are on hand quickly and cheaply.

No other device furnishes so much accurate information. On the oscillogram is a complete record of what happened during and immediately following the system disturbance. It gives relay and circuit-breaker operation, fault duration, and magnitudes of short-circuit currents. You get the facts accurately, and in a form easy to interpret and file.

A necessary maintenance tool, not a laboratory instrument, is the G-E Type PM-13 automatic oscillograph. Sturdily built for use by station operators, it still has a remarkable accuracy. It fills a long-felt need of the power industry. It is the only oscillograph designed for mounting directly on a station switchboard.

Investigate the uses of this G-E oscillograph. There are many ways it can save you money. Get in touch with your nearest G-E sales office or the General Electric Company, Schenectady, N. Y.

**HEADQUARTERS FOR ELECTRICAL MEASUREMENT**



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430-91

**GENERAL ELECTRIC**

# Industrial ELECTRIFICATION

***New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers***

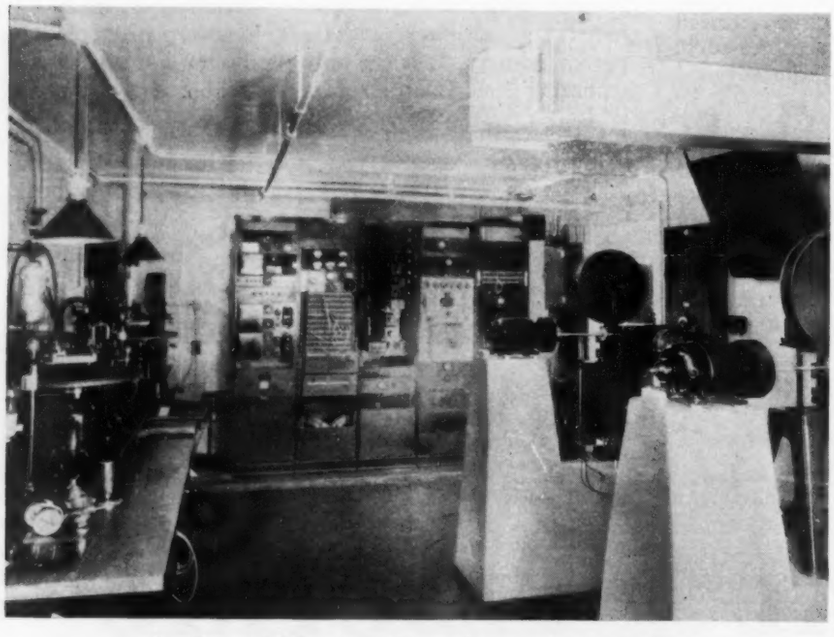
## Use Conditioned Air for Radio Recordings

The fidelity with which radio programs can be recorded in advance for subsequent use in electrically transcribed radio programs is dependent to a large extent upon the fineness of the recording work, care in the cutting of the original wax record and the skill and technique employed in the production steps leading from the wax disk to the finished record. Accurate control of temperature and humidity conditions and the elimination of all dust and dirt in the air are absolutely essential if high quality records are to be obtained.

To this end, therefore, the World Broadcasting System, Inc., employs air-conditioning equipment of 80 tons ice capacity (180 hp.) to control atmospheric conditions in its recording process. During the delicate operation of cutting the original wax disk from which records are subsequently made temperature is thermostatically controlled within 1:5 deg. F. This is necessary since wax disks that are too cool have a tendency to chip at the edges of the groove and, if too warm, the stylus tends to push the wax apart rather than cut it. Both extremes give rough grooves and a noisy record. Humidity control is necessary since wax is highly moisture-absorbing. Excess moisture causes the wax to "bloom" or assume a pebbled surface ruinous to the wax record, whether blooming occurs before or after the recording is made, since it distorts the grooves. Relative humidity between 35 and 45 per cent is maintained to prevent occurrence of this condition.

All air entering the processing rooms is carefully filtered by passing it through "glass wool" filters. Similar filters are also placed in the exhaust ducts. These precautions were taken to prevent dust or dirt particles from collecting in the grooves of the record either during cutting or subsequently during the manufacture of the finished record.

Finished records are made of acetate or vinylite and are 16 in. in diameter. There are 129 grooves to each radial inch of the record and each record is capable of playing for a duration of fifteen minutes. During this time the needle travels a total distance of ¾ mile. This is a striking contrast to the average phonograph record, which is usually 10 in. in diameter and has 80 to 90 grooves per radial inch.



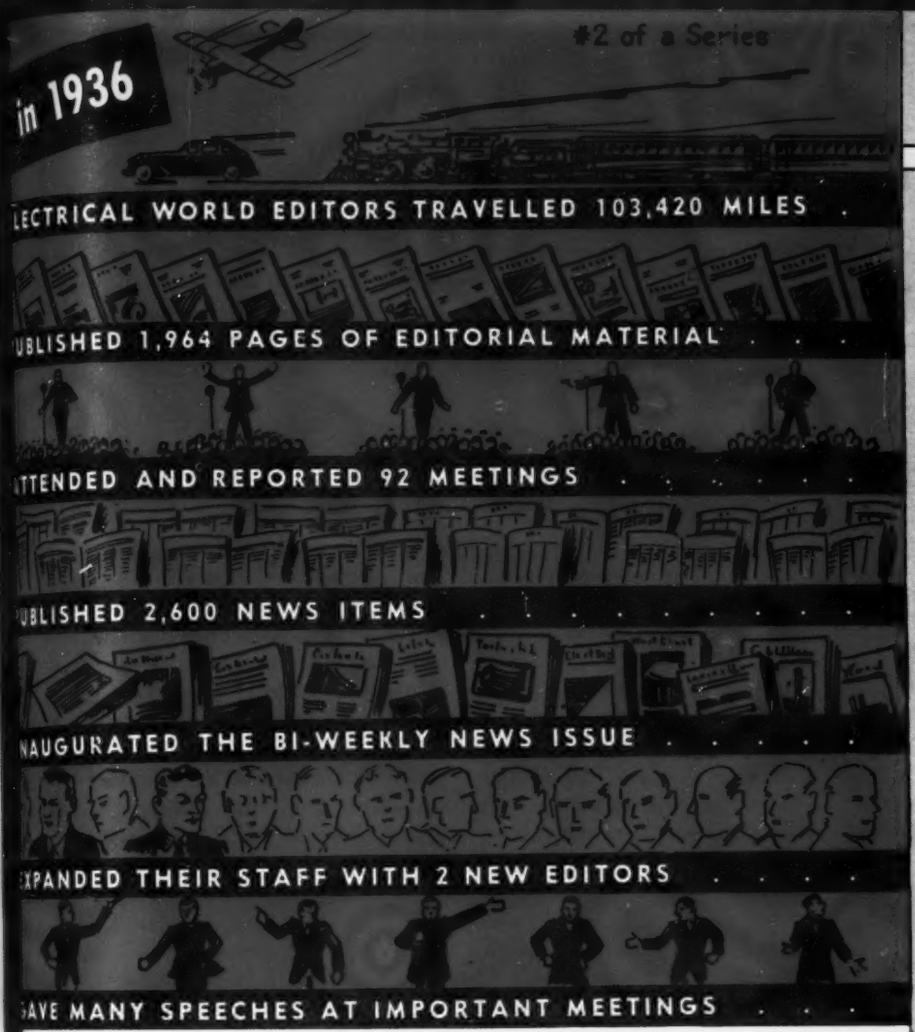
**Conditioned laboratory for making radio recordings**

•

## Primary Switch Averts Core Losses

By K. B. HUMPHREY
Sayreville, N. J.

In an industrial plant a 100-hp. motor is direct connected to a centrifugal pump which is used only in case of fire. The motor is three-phase, 220 volts and is supplied by a bank of two 50-kva., 2,300- to 230-volt transformers. A 2,300-volt oil circuit breaker was placed on the incoming line and mounted on a crossarm above the transformers. The switch is operated by means of a pole which is kept in the pump house. By using the switch the transformer bank is connected onto the line only when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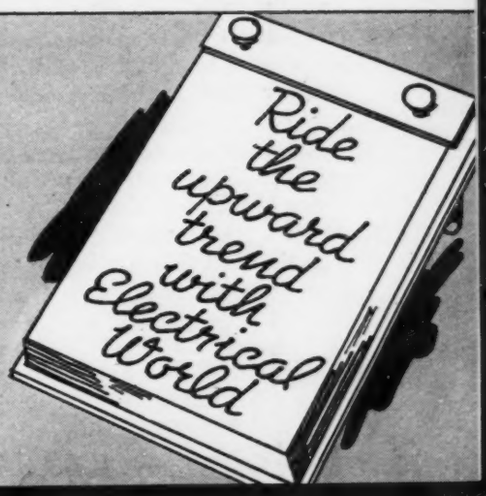
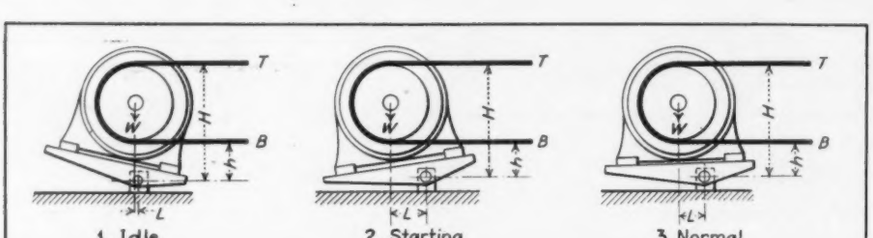





**Weight moment balances belt-tension moment**

When the motor is idle, the belt is unstretched and the center of the motor is almost directly above the hinge; that is, the distance $L$ is smallest, just as it should be. Upon starting, the motor automatically "backs into the belt" and the distance $L$ becomes greatest. In other words, the motor does precisely what it *should* do, for best results. Finally, when the load becomes normal, the motor swings slightly toward the right and the distance $L$ decreases to normal. This, again, is what it *should* do.

power is required. The core loss of an up-to-date transformer of this size will run around 200 watts and for some of the older type it will run much higher. Figuring conservatively the loss on the bank would be 400 watts. With the switch left closed it would mean that 400 times 720 hours or 288,000 watt-hours or 288 kilowatt-hours would be consumed each month. The annual amount would be 3,456 kilowatt-hours, which is well worth saving.

Normally the pump is run about an hour each month just to see that everything is in working order. The switch is an ordinary oil breaker adapted for outdoor use, has no under-voltage or overload coils and is used simply as a disconnect.

•

# Rocking Motor Does Just the Right Thing

By W. F. SCHAPHORST
Newark, N. J.

Now that hinged belted motor drives are coming into general use, there are numerous "explanations" for the automatic rocking action of the motor. One writer claims that this swinging of the motor is caused by "centrifugal action." Another says it is due to "inertia" of the motor. Some say the belt tensions "are always the same," ignoring entirely the fact that the motor swings considerably around the hinge, continually decreasing and increasing the lever arm $L$.

All of these explanations are incorrect. The true reason why the motor "backs into the belt" is due to the fact that tensions $T$ and $B$ vary with the load. When idle, the tensions $T$ and $B$ are equal and $T$ may be greater than it is at any other time. Since $T$ has the greater lever arm, $H$, it naturally pulls the motor toward the right.

Next, when the motor starts, the tension $B$ increases and $T$ reduces. Often the tension $T$ becomes almost zero. And what is more, the greater the movement of the motor toward the left the shorter $h$ becomes, all of which is favorable to the production of the highest necessary tension $B$ when starting.

Finally, after the load is up to speed and conditions become normal, the tension $B$ automatically reduces and $T$ increases. The increase in $T$ and the advantage of its longer lever arm $H$ pulls the motor back to normal running position. All of which is as it *should* be. The motor automatically does the *right thing*, all the time.

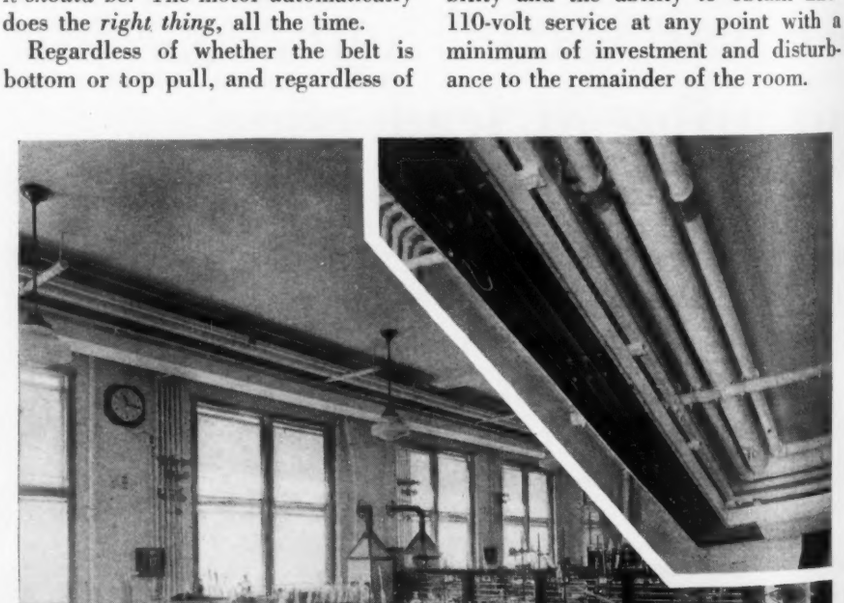
Regardless of whether the belt is bottom or top pull, and regardless of the direction of the belts, the same principles apply to any problem. It is always possible to calculate arithmetically and foretell the exact action of the motor, knowing the weight and characteristics of the motor, and knowing the various lever arms, $L$, $H$ and $h$.

•

# Overhead Bus Solves Distribution Problem

Power requirements of industrial laboratories vary widely in the classes of service necessary and must be inherently flexible to meet the needs of changing experiments. At the plant of the Shell Development Company, Emeryville, Calif., a new distribution scheme has been tried with great success. It consists of an overhead bus suspended from the ceiling (bottom plate removed in illustration) and housed in a metal inclosure. Where circuits are required in the room, the bus is tapped and conduit carried down the wall through fuseless circuit breakers to the outlet. The accompanying illustration shows both the technique employed and the arrangement of outlets on the bench.

Features of the system: Large electrical capacity for a small space; flexibility and the ability to obtain 220-110-volt service at any point with a minimum of investment and disturbance to the remainder of the room.



**Suspended bus serves industrial laboratory**

CITY OF CARTERSVILLE
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COMMISSION GOVERNMENT
WATKINS OVERTON, Mayor
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September 6, 1936.
Square D Company
207 Pyramid Building
Little Rock, Arkansas
Attention: Mr. Ray Walker.
Gentlemen:
After examining the new Multi-breaker Load Centers, I am pleased to report that it is one service entrance device that really qualifies for the requirements of proper and efficient service entrance devices from the inspector's viewpoint.
It seems that this device will be one answer to a long felt need for a safe and fool-proof line of entrance devices which will eliminate the danger of improper fusing of circuits and still is so simply constructed that the average householder will experience no difficulty in its operation.
I most heartily recommend the use of the Multi-breaker Load Center in our city where applicable.
Yours very truly,
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## SQUARE D MULTI-BREAKER

**Municipal Electrical Inspectors not only approve the Square D Multi-breakeR—they actually recommend it.**

**And they do so because: The Multi-breakeR replaces the usual service entrance switch and fuse box. It automatically breaks the circuit when a "short" or overload occurs and the service can be restored immediately with a flip of a lever, unless the danger continues. It provides circuit breaker protection at a new, low cost.**

**The breaker units are calibrated and sealed at the factory. Protection is permanent and cannot be altered or nullified.**

**For the householder it eliminates the cost and inconvenience of changing fuses and means fewer service calls for the power company, as well as shorter service interruptions and greater customer satisfaction.**

**The Multi-breakeR is a decided sales asset when included as an accessory to all electric range and water heater campaigns.**

**Write for Bulletin CA-543**

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**CALL IN A** SQUARE D COMPANY ELECTRICAL EQUIPMENT **SQUARE D MAN**

# New ENGINEERING IDEAS

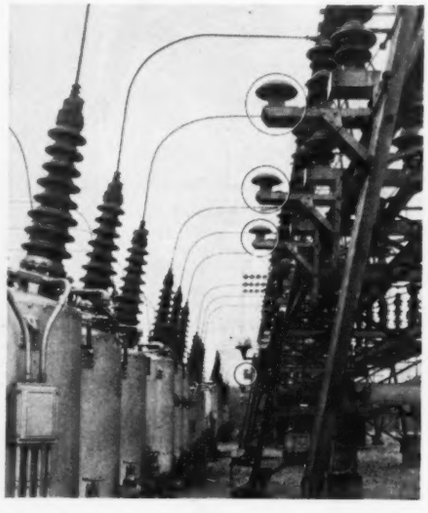
*Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory*

## Coupled Unit Gives Voltage Indications

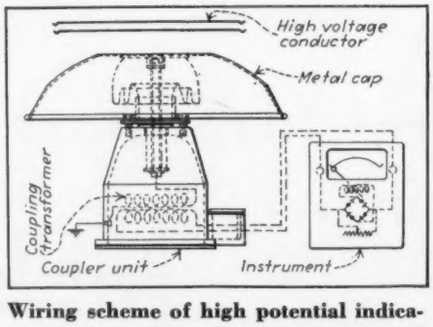
Mounted in a suitable place on pole, tower or structural work, in a calculated capacitive relation to transmission or substation conductors, a new device developed by the Roller-Smith Company, New York City, combines functions of a potential indicator and synchroscope in that it supplies station operators with a continuous indication of line potential and also indicates relative phase position for synchronizing two or more lines.

A bowl-shaped metal plate inverted on the coupler unit of this device forms the center plate of a condenser the outside plates of which are the high-voltage conductor and ground. Electrostatic charges accumulated on this plate are conducted to ground through the high impedance primary of a coupling transformer, the secondary of which is connected to an indicating instrument in the station control room. The instrument is a D'Arsonval milliammeter with rectifier. When the line is energized a rheostat connected in series with the instrument rectifier circuit is adjusted to bring the pointer to a point on the scale about three-quarters full scale. When the line is dead the pointer remains at zero.

Since output of the coupler unit corresponds in phase position as well as voltage value to the high-voltage line, the outputs of two units in corresponding phases of two sources of supply can be "bucked." The voltages indicated on the instrument will then be proportional to the instantaneous phase displacement between the two sources of supply. Thus it is possible actually to synchronize across the high-tension circuit breakers with the "Hipot" indicator. The fact that the indicator does not depend upon connection to insulator strings or bushings eliminates variations due to atmospheric conditions.



**Coupler units mounted in capacitive relation to high voltage conductors give voltage-phase indications**




**Wiring scheme of high potential indicator which can be used to operate ground detector relays**

Current in the primary of the coupling transformer is controlled by the spacing of the coupler dome from the high-voltage line. Spacing for various voltages should be as follows: For 33 kv. spacing should be 1½ ft., for 66 kv. it should be 2½ ft., for 110 kv. 3 ft. and for 220 kv. about 7 ft.

For signaling or ground detection work output of the coupler unit is sufficient to give positive operation of relays. For example, on an ungrounded three-phase line when three coupler units, one in each phase, have their secondaries connected in delta with polarity such that normally the sum of voltages will be zero, a relay coil in the delta will be normally de-energized. A ground fault in a phase will unbalance the voltages to ground and energize the relay to give an appropriate warning.

•

## Apparatus Simplifies Jewel Inspection

**By P. L. ALGER**
Portland (Ore.) Electric Power Company

Most satisfactory results have been experienced by the Portland General Electric Company, Portland, Ore., with a technique and apparatus for meter jewel testing which it has developed over a period of two years.

For jewel examination a Spencer binocular microscope is employed. With such an instrument proper lighting is of the utmost importance, for without it many defects, especially small pivot worn spots, are not visible. The lighting system found best suited for this consists of a 200-watt spotlight and prism which direct a light beam into the jewel cup.

A gimbal-jointed holding device, which allows every part of the jewel surface to be brought under the spot

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Eight men! A combined weight of more than 1,000 lbs. That's acceptable evidence, we think, of the super-safety and super-service built into our new improved ladder rig.

Both in design and materials, it sets new quality standards. Note the trusses giving extra strength to cantilever uprights. And those uprights are of airplane Sitka spruce of Army and Navy specification. Rungs are of hickory, reenforced with steel rods and new-type combination ferrule-brace attachments.

Here's a ladder rig that will give years of economical dependable service with safety — Hundreds of working positions. Mountable on any light commercial truck. Moderately priced.

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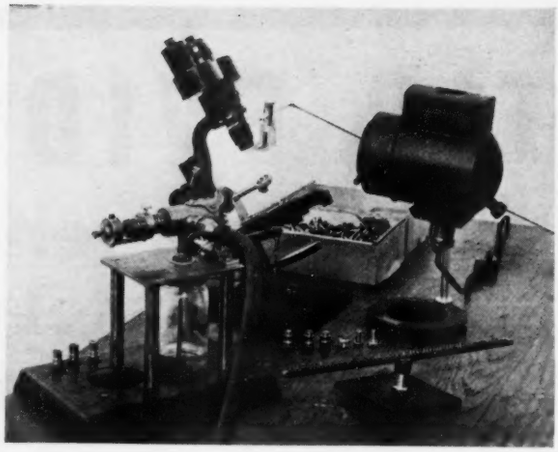
**Brooklyn, New York**

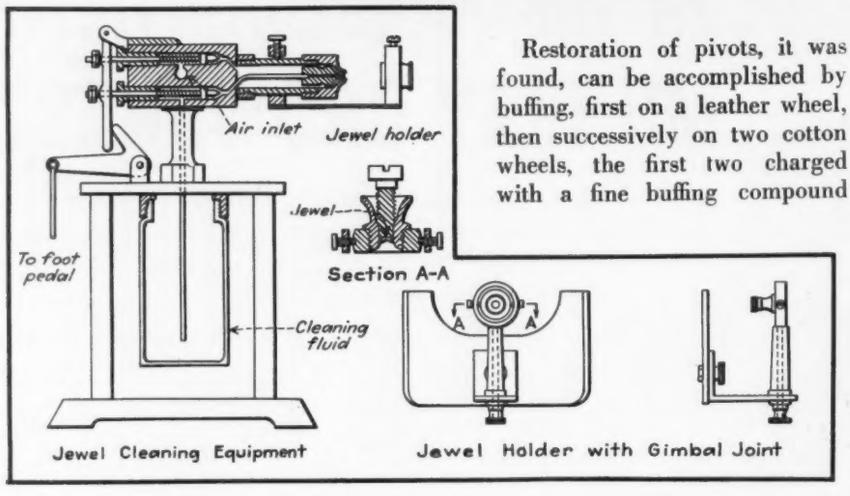
# MURRAY DEMOUNTABLE CROWSNEST

**Assembled equipment for modern jewel inspection and cleaning**

Included are the spotlight and prism, binocular microscope, holding devices and air-blast spray cleaner.



**Cleaner and holding device permit all portions of jewel surface to be examined while jewel remains within focus of the microscope**




of light, so holds the jewel that it is always in focus. Adapters accommodate different types of jewels.

The jewel cleaner is a spray gun, constructed to emit either air alone or air and solvent. Propylene dichloride was found superior to carbon tetrachloride for this use, in regard to fumes and corrosive effects. Filtered compressed air is used.

To save time and solvent, all jewels are not cleaned. They are first examined. Large pivot-worn spots and badly damaged jewels can easily be seen without cleaning, and only those that seem to be good are cleaned.

Examination procedure is: Sorting jewels into boxes according to type; setting of adapters in cleaner and microscope according to jewel type to be examined; discarding of jewels found to be defective; cleaning of jewels showing no worn spots, by means of breaking crust with an orange stick and subjecting to 1/5-second blast from the cleaner; re-examining of cleaned jewels and return of perfect ones to use. Between 100 and 200 jewels can be examined per hour.

Restoration of pivots, it was found, can be accomplished by buffing, first on a leather wheel, then successively on two cotton wheels, the first two charged with a fine buffing compound and the last with No. 3 alumina powder. Since jewel bearings, unlike metallic ones, do not "run in," placing new pivots in worn jewels often merely accelerates breakdown.

On the basis of more than 32,000 jewel examinations, the Portland company has found the foregoing methods most satisfactory. Concentration of testing upon a limited number of men who can become expert in the craft and the fact that defects are visualized rather than felt improve results. Economic advantages await calculation upon elapse of a meter test period.

•

# Stabilizer Simplifies Driving Ground Rods

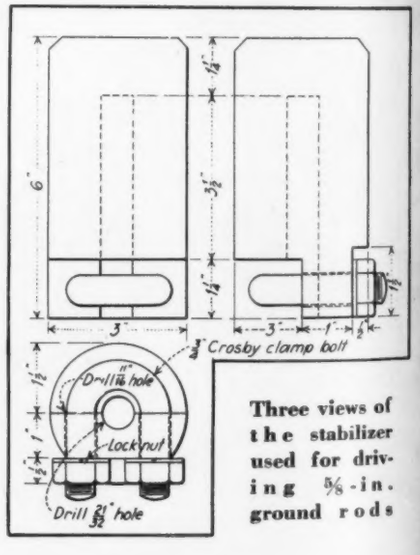
By TRUEMAN T. SMITH

Puget Sound Power & Light Company, Seattle, Wash.

For driving an occasional ground rod, such as a line crew might do in a day's work, a 10-lb. sledgehammer is generally used. This method is satisfactory unless hardpan is encountered. Then the rod will begin to vibrate and swing with every blow until finally it bends. The obvious remedy in such a case is to substitute a larger diameter rod with greater rigidity. This, however, is costly both in time and material, the larger rod requiring more time to drive and involving excess material for the job.

The engineering department of the Puget Sound Power & Light Company, in experimenting with this problem, discovered that the small diameter rod could be driven readily into hardpan providing a weight of approximately 10 lb. was fastened to the end of the rod. Apparently this weight acts as a stabilizer and absorbs most of the vibration, thereby allowing the full force of the driving blow to act in the downward direction. A cap made from an old truck axle and illustrated herewith is now standard equipment on the line trucks. It protects the end of the rod from "mushrooming" and allows the ground clamp to be slipped on easily. The truck axle was selected as a material because of its inherent toughness which enables it to withstand repeated hammering.

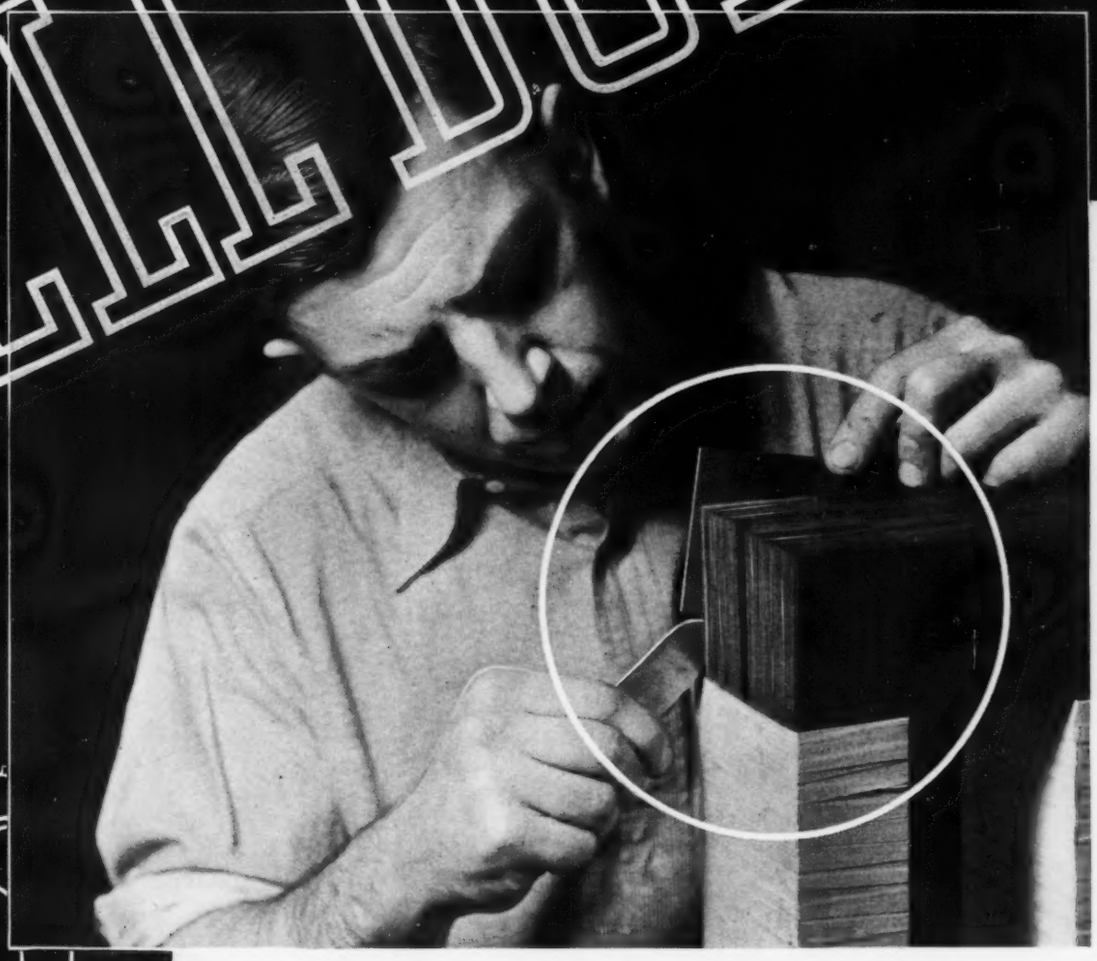
Experimental test data prove the efficacy of the device. A 5/8- and a 3/4-in. ground rod each were driven in extreme hardpan. Without the stabilizer, the former entered the ground 1 in. before bending and the latter entered 6 in. before bending. The stabilizer was then attached and the smaller rod was driven in 6 ft. in fifteen minutes and the larger 6 ft. in 35 minutes. With the exception of the stabilizer, conditions were identical and the time saved is indicative of the saving which can be made by using this simple device.

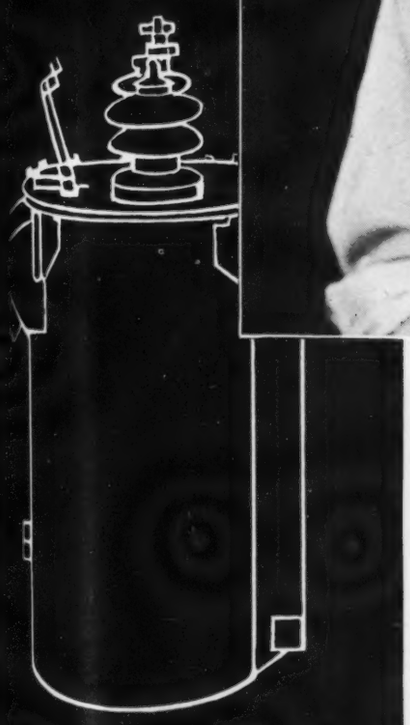



**Three views of the stabilizer used for driving 5/8-in. ground rods**

★ A LITTLE THING

# WELL DONE





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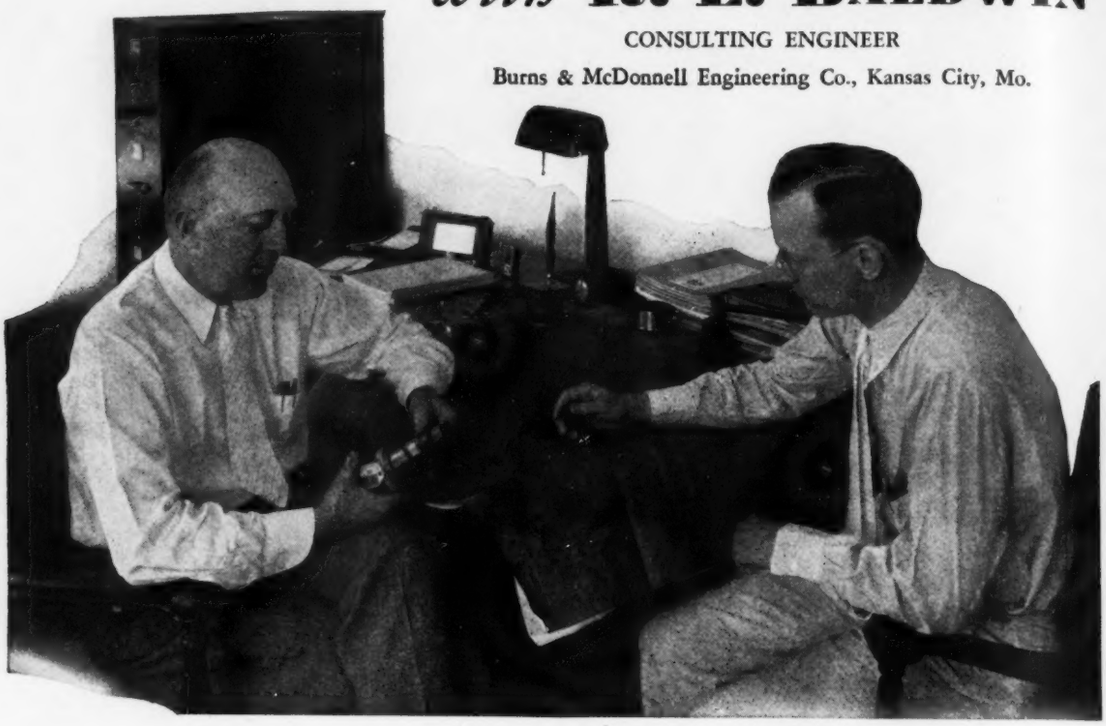
CONSULTING ENGINEER

Burns & McDonnell Engineering Co., Kansas City, Mo.



CONCERNED largely with the design of power plants, pumping stations, appraisals and reports on public utilities, R. L. Baldwin has been connected with Burns & McDonnell Engineering Company for thirty years and a member of the firm for sixteen years. His many responsibilities are best illustrated by this typical day's work:

Devoted early morning hours to discussing various design problems with staff engineers on various projects which are under way.

Conferred with manufacturers' agents regarding turbine speed and new developments for a 30,000 K.W. generating unit, for which specifications are being prepared for the City of Kansas City, Kansas. (Letting date July eighth.)

Received long distance call from our supervising engineer, Fred W. Sage, from the power plant under construction for the City of Fort Collins, Colorado, regarding some detail of construction.

Answered routine correspondence.

After lunch, conference with Ralph Duval Assistant Manager, Elmer Chapman, Superintendent of Power Station, and other operating engineers of the power plant at Kansas City, Kansas, regarding various details to be incorporated in specifications to be prepared for a new steam generating unit, turbine, and condenser for a power plant addition.

Talked on long distance to D. Elrow Crane, manager of the municipal electric light plant at Columbia, Missouri, regarding certain changes to be made in the setting of two boilers which will be overhauled within the next month.

Had evening conference with Major Julian Bagby and Council Committee, of Sedalia, Missouri, and Charles Mayer, attorney for the City Light & Traction Company, in regard to rate adjustments in an attempt to negotiate a rate revision without carrying the matter to the State Public Service Commission. (Negotiations have been successfully terminated.)


### *Keeps abreast of industry progress with Electrical World*

A subscriber to Electrical World since before graduation from Missouri University in 1906, R. L. Baldwin says, "A complete file of Electrical World has been kept from 1904 to date, and has been found very valuable for reference purposes. It keeps me abreast of all advances in the electrical field and is one trade journal I read regularly."

Manufacturers, too, can keep "abreast of industry progress" and capitalize on the upward trend through advertising in Electrical World. May we provide more details? ELECTRICAL WORLD, McGRAW-HILL BUILDING, NEW YORK, N. Y.

# *five reasons*

## WHY UTILITIES ARE TURNING TO A CENTRAL FILING SYSTEM

IN no other business can a lost or misfiled paper cause quite so much grief. In matters of dispute or litigation, evidence must often consist of such varied records as correspondence, contracts, leases instructions, plans, agreements, orders, actions, minutes, printed forms, or tracings. Failure to locate any part of such material when wanted may well be the sole reason for losing an important case.

Under present conditions, utilities operating under a departmental filing system, find it increasingly difficult to collect the complete story of any transaction for executive decision. On the other hand, one important utility writes:

"Our executives are increasingly enthusiastic over our Remington Rand Central Filing System. After eight years of performance, these worthwhile advantages can be definitely summarized:

**1** Decrease in payroll costs through time saved by correspondents, stenographers and clerks.

**2** Reduction of operating costs through (a) the saving of floor space, filing cabinets and supplies; (b) by the use of full capacity of each filing cabinet; (c) by the elimination of duplication of folders and guides; (d) by withdrawal of inactive material from current equipment; and (e) by the proper transfer and storage of material with a definite period for retention and destruction.

**3** Responsibility fixed for producing at once a given piece of material or collection of material regardless of the topic, date or departments handling the matter, as well as no interruptions to the staff outside of the filing department.

**4** Decrease in errors and increase in production of file clerks, part time stenographers and other employes, each concentrating through specialization on one important, definite task.

**5** Elimination of duplicate reports, forms and correspondence by bringing together all material on one subject. One copy only need be kept permanently thus saving file, drawer and floor space, as well as labor."

Do your files produce what you want when you want it? Is your system costing you more than it should? If there is any question in your mind call the Remington Rand man. Let him study your present set-up . . . suggest changes. Phone the Remington Rand office in your city now, or write Remington Rand Inc., Buffalo, N. Y.

**OK.. it's from Remington Rand**

# Building Up THE LOAD

***New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers***

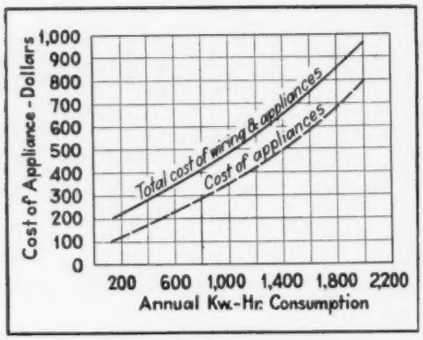
## Farm Equipment Costs vs. Use

By D. B. LEONARD
Agricultural Agent
Pacific Power & Light Company *

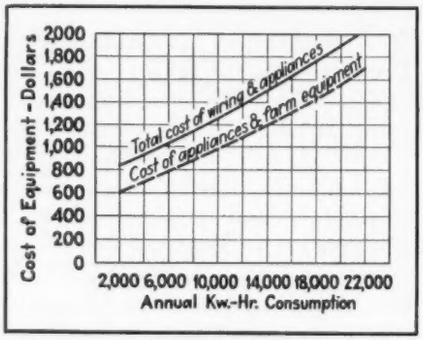
Equipment used by farms served by the Pacific Power & Light Company was carefully surveyed in 1935 on 8,505 farms and at conservative prices it represented an investment of $3,250,000, or approximately $382 per farm, not including wiring costs. To establish definitely the relationship between the investment in utilization devices and the annual kilowatt-hour consumption 100 farms were selected over a wide area in Oregon and Washington on which information was secured and charted by the shotgun curve method to show equipment costs and power used. Farms selected were of all types—fruit, hay and grain, potato and truck, dairy and poultry. Typical customers were selected in each group, including some of the best users, some of the poorest users, and a number representing average users. The data were plotted on one chart to show trends when the use totaled less than 2,000 kw.-hr. annually, and on another chart when the use exceeded 2,000 kw.-hr. annually.

Wiring costs, including lighting fixtures, averaged $134.03 per farm and were added to the cost of appliances as shown by the up-curve of each chart. From the first chart it will be observed that for the use of a small number of current-consuming devices using 2,000 kw.-hr. annually farmers would be required to have an investment of $800 in equipment alone. This amount of electricity at average rates would cost slightly more than $50 a year, but the equipment to use the power would cost sixteen times that amount. When irrigation pumps and other large current-consuming devices are used the cost of electricity becomes a larger percentage of the equipment cost, and in case 20,000 kw.-hr. is used annually the cost of equipment would be $1,600. In one case included in this survey the equipment in use on a farm actually cost $4,000, which did not include wiring.

For a modest farm home it is going to cost, in round figures, approximately $1,000 for wiring, appliances and equipment, including a water supply system and plumbing. This home would probably use 2,000 kw.-hr. annually, which would cost $50. The cost to prepare to use electricity is twenty times the amount of the $50 electric bill. Farmers would not hesitate to spend $5 a month for the electricity to operate these conveniences, but very few are able to secure the $1,000 to buy the equipment to use the electricity. This is especially true if the farm is heavily mortgaged or if taxes have not been paid during the past few years.




**Investment in electric appliances vs. energy consumption on Oregon and Washington farms**




**Investment in electric appliances and power equipment vs. energy consumption on Oregon and Washington farms**

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## Incentive Aids Lamp Sales

As a part of the Rocky Mountain Electrical Association's fall campaign to sell 25,000 I.E.S. lamps the Public Service Company of Colorado has evolved a program to insure its reaching its quota of 10,000 units. Previous experience proved that sales leads gained from employee tips produced a high percentage of orders. Therefore, the fall program, which will run between September 1 and December 25, is designed to encourage employee participation through the use of attractive rewards and commissions.

All employees who turn in a tip which results in the sale of an I.E.S. lamp are paid a commission on a

* Reprinted by permission from "C.R.E.A. News Letter."

# ere is no substitute for Confidence

's strife for leadership often
ds to imitation—his struggle
success frequently ends in sub-
ion. Greatness has ever had
y imitators—excellence many
titutes.
he great man never lived whose
ds did not claim equal great-
. No product truly great was
without its "just-as-goods."

But leadership, be it in product or in man, defies imitators—it draws with a power all its own—it has no substitute.

There is no substitute for SAFECOTE. The electrical conductor that is flame retarding, moisture resisting *and* fishable, SAFECOTE stands alone, backed by such confidence as only leadership enjoys.

ELECTRICAL

FLAME RETARDING MOISTURE RESISTING
SAFECOTE
FISHABLE — SLICK FINISH
REG. U.S. PAT. OFF.

CONDUCTORS

U. S. LETTERS PATENT NUMBERS:
1,635,829 1,772,436 1,765,000
1,798,486 1,410,790 1,536,549
OTHER PATENTS PENDING

INSIST UPON GENUINE SAFECOTE FOR YOUR PROTECTION

**BUILT AND TESTED TO SAFECOTE STANDARDS BY THESE LEADING WIRE MANUFACTURERS**

American Steel & Wire Company
Anaconda Wire & Cable Company
The B. M. Austin Company
Bishop Wire & Cable Corporation
Clifton Conduit Company
Collyer Insulated Wire Company
Crescent Insulated Wire & Cable Co.
General Cable Corporation
General Electric Company
Habirshaw Cable & Wire Corporation
Hazard Insulated Wire Works Div. Okonite Co.
National Electric Products Corporation
Paranite Wire & Cable Company
Providence Insulated Wire Company
John A. Roebling's Sons Company
Simplex Wire & Cable Company
Triangle Conduit & Cable Co., Inc.
United States Rubber Products, Inc.

ECOTE PERFORMANCE SPECIFICATIONS AVAILABLE UPON REQUEST
SAFECOTE LABORATORIES ARE AT YOUR DISPOSAL
GEORGE C. RICHARDS, LICENSOR'S AGENT • 155 EAST 44th STREET, NEW YORK

## Tip to Power Salesmen

**"We find that the smaller plants respond more readily and easily to our advertising and promotional work and therefore the major portion of the heating that has been sold has been in the plants of the smaller customers. In general, we find it hard to get a successful hearing in the large plants, where one man is responsible for one department and another man for the next. I have pointed out before that perhaps the engineering divisions of the large plants should be our targets instead of the operating men because they design and select nearly all plant equipment. This has been tried out in the case of the ———— Company and the ———— Corporation, and has netted us heating load that I don't believe would have been got otherwise."**

***—Excerpt from report of a heating sales specialist to his sales manager.***

graded scale, the commission for the first order being 50 cents and continuing up to a maximum of $1 for each order taken from the leads supplied by the employee. In addition a main prize of a $1,000 automobile will be given away in the group of employees who participate in the campaign. Every order resulting from a tip supplied by an employee entitles that employee to one chance on the automobile; the more successful sales leads being supplied by the employee the more chances he has to win the main prize.

In addition there are a total of $500 in cash prizes to be awarded purely on the basis of the number of tips resulting in sales turned in by any one employee. Thus the employee having the greatest number of successful tips will win $200, the next highest number $100, the third highest number $50 and the remainder of the cash prize money distributed in smaller amounts. By this method of distribution of prizes employees who work hardest and turn in the most number of successful sales leads are sure to obtain substantial cash reward and will have more chances in the lottery for the automobile.

E. W. Rowland, in charge of retail sales in Denver, heads the I.E.S. lamp campaign in that city, where it is expected that 6,000 of the 10,000 units will be sold. The remaining 4,000 units comprise the quota for the outlying districts. Selling in those districts will be under the direction of Frank S. Peterson.

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## Electric Heat Told in the User's Terms

By H. R. STEVENSON
The Detroit Edison Company, Detroit, Mich.

If we estimate that a 1-kw. heater is to be used two hours a day for 250 days in the year it is easy to figure what the utility will get in terms of revenue. But the user won't bother with such figures except to say they're too high and it is not smart at all to emphasize or even to mention what he pays; i.e., what the company gets. Rather, it is much pleasanter to tell the customer what he gets, what a 1-kw. electric heater working only two hours a day 250 days a year or an equivalent time will be for him in his particular business. It will:

Heat 2,000 gal. of water to 212 deg.
Silver 2,000 mirrors 18x24 in.
Melt 20 tons of solder.
Cook 3½ tons of potato chips.
Press 1,000 suits of clothes.
Heat a room 10x10x7 ft. for 30 days with zero outside temperature.
Hold 3,000 gal. plating solution at 180 deg. for one month.

Expressed in terms such as these, the plant man can readily see that electric heat isn't expensive. Whenever possible the power salesman should thus present first the performance of the heater in the user's terms, giving the cost a secondary position.

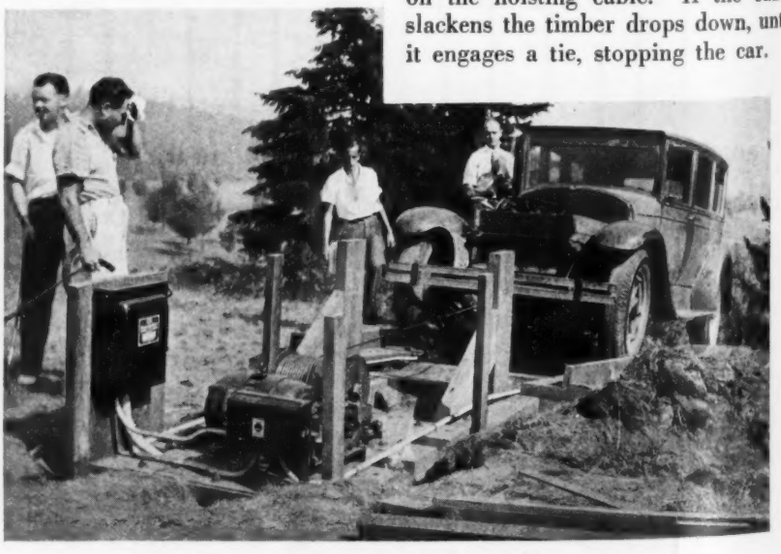
## Electric Tramway for Tired Golfers

By H. W. YOUNG
Portland, Ore.

Ardent but "winded" golfers get a "lift" up the steep 70-ft. rise between the eleventh green and twelfth tee at the Lake Oswego Country Club, Oswego, Ore., on a home-made tramway built by the club manager, W. J. Kerry. An electric hoist mechanism, mounted and anchored on a platform at the top of the incline, hauls the cable car—an ancient seven-passenger sedan minus motor, transmission and rear end assembly—up and down the plank track, a distance of 215 ft., in a little under two minutes.

Automatic control stations located at the top and bottom of the cableway send the car up or down the slope from either station. The charge is a dime a trip regardless of the number of passengers. This pays for the power used as well as the upkeep and amortization of the equipment. The plant and equipment for the "golfers' tramway" including labor and supplies cost $700 and included the following: Automatic hoist (37½ to 1 reduction), 7½-hp. line-starting induction motor, automatic electric brake, line starter, standard safety switch, two-station automatic elevator control with coin-in-slot attachment and 215 ft. of ½-in. wire rope.

Aside from the safety feature represented by the electric brake, there is another consisting of a heavy stick of timber hung longitudinally under the car. The front end is hinged and the rear end is held up by a runner on the hoisting cable. If the cable slackens the timber drops down, until it engages a tie, stopping the car.



**Electric tramway carries golfers up steep incline**

# FORD INTRODUCES FOR 1937

# 2 V·8 ENGINE SIZES

**85** HORSEPOWER FOR HIGH SPEEDS OR HEAVY DUTY

**60** HORSEPOWER FOR LIGHT DELIVERY SERVICE

## CHOICE OF POWER TO FIT YOUR NEEDS

With these two great V-8 engines, Ford offers a full line of optional equipment to apply power with greatest economy and to meet individual load requirements. These options make many combinations available, one of which will do your hauling or delivery job at the lowest cost. No compromise truck can give you such economy.

In addition, Ford introduces the most advanced style in truck design . . . and many other features that assure greater economy and longer life. Get the facts about this new Specialized Transportation from your Ford Dealer. Call him today and set a date for an "On-the-Job" Test.

*Convenient, economical terms through the Authorized Ford Finance Plans of the Universal Credit Company*

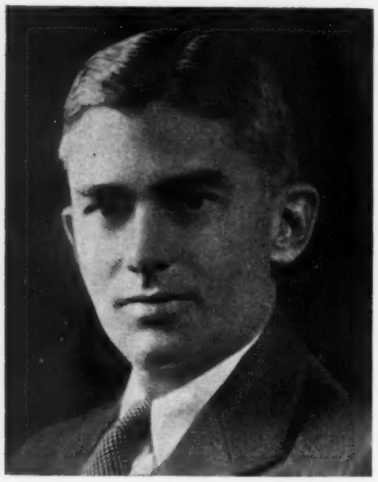
# 1937 FORD V·8 TRUCKS

**Matching the HIGHEST in Quality...Selling with the LOWEST in Price**

# News ABOUT PEOPLE

## Marshall Made Chairman of N.E.M.A. Range Division

Richard B. Marshall, president of Electromaster, Inc., has been selected as the 1937 chairman of the range division of the National Electrical Manufacturers Association. Recog-



nized as an engineering authority in the electric range industry, Mr. Marshall has made exhaustive investigations during recent years which have carried him to England and the Continent. He has been president of Electromaster since 1934 and has been associated with that organization since its inception.

•

## G. E. Appliance Sales Promotion Decentralized

Decentralization of General Electric's appliance sales promotion activities, in accordance with a policy recently adopted, has been announced by the company's appliance and merchandise department, Bridgeport, Conn. J. W. McIver, for several years manager of appliance promotion, has resigned to join Maxon, Inc., advertising agency, and the duties formerly assigned to Mr. McIver have been apportioned among the appliance divisions of the Bridgeport organization. Promotional functions are now in charge of W. D. Yates, for composite promotion and exhibits; G. H. Libbey, for G.-E. Hotpoint heating devices and sunlamps; C. T. Wandres, for radio; J. K. Kay, for home laundry equipment; W. E. Sawyer, for electric cleaners; E. A. Macaulay, for fans, and D. B. Hollister, for clocks.

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## R. P. Taylor Elected Head of New England Group

Richard P. Taylor, New England sales manager of the Square D Company, has been elected president of the Electrical Manufacturers' Representatives Club of New England, succeeding William Etzell. William V. Haynes, manager Hatheway & Patterson Company, Inc., Cambridge, Mass., has been elected vice-president, and Harry J. MacDonald, manager of

the wire and tape division of the United States Rubber Products Company, Boston, succeeds Mr. Haynes as secretary of the club. Charles D. White was re-elected treasurer.

## W. C. Mainwaring Appointed General Sales Manager

W. C. Mainwaring, formerly merchandise manager of the B. C. Electric Railway Company, was recently promoted to the position of general sales manager of the company. The

announcement presages organization of a general sales department and unification of the sales policy of the company's various selling units. Mr. Mainwaring will guide co-ordination of light and power, electric and gas merchandise, and new gas sales efforts.

E. E. Walker, formerly sales engineer for the company, is now light and power sales manager, and will have direct charge of the light and power sales policy of B. C. Electric.

•

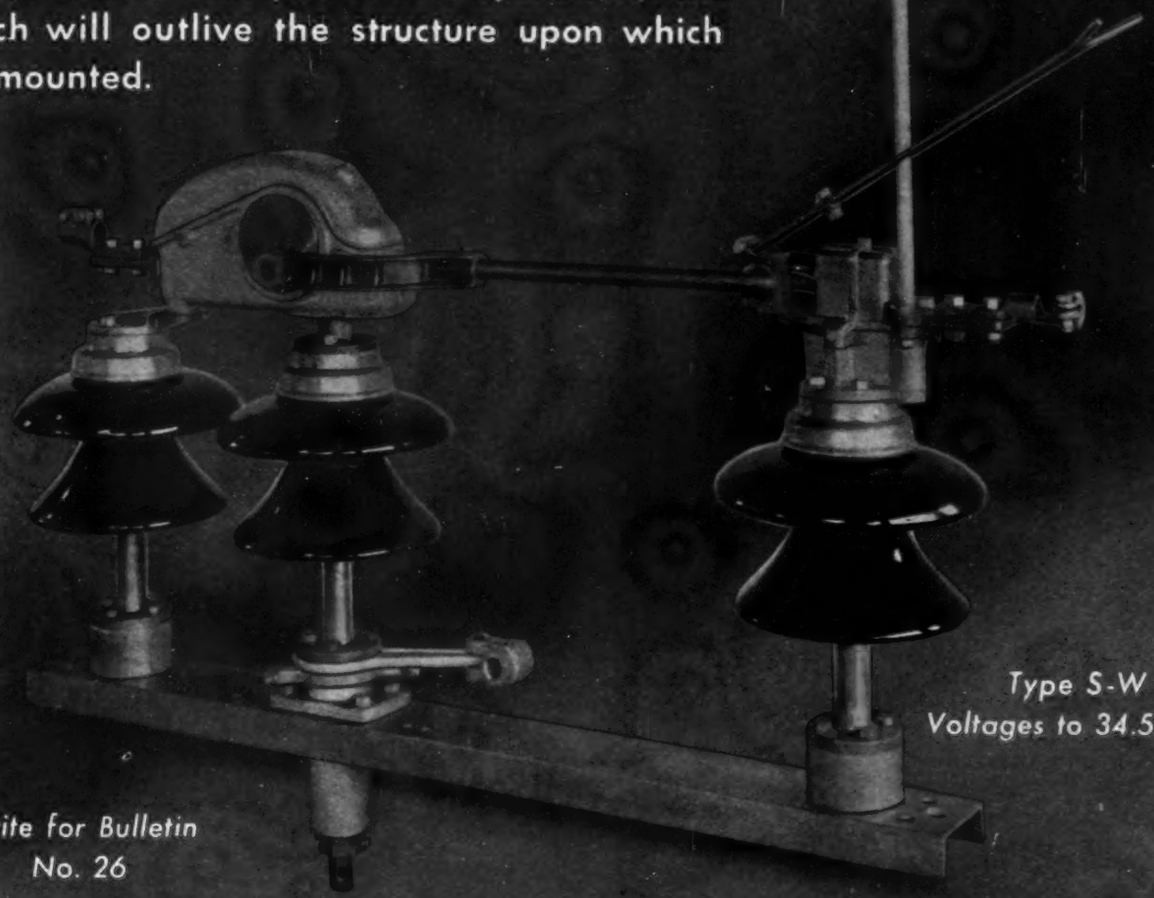
► W. L. BRANDEL has joined the national sales force of Curtis Lighting, Inc., Chicago, in charge of X-ray reflector and floodlighting equipment sales. Mr. Brandel is well equipped for his new responsibilities, having spent fifteen years in the incandescent lamp department of the General Electric Company. During the interim of

# MASTERPIECE
## OF TWO
## ENGINEERING FIELDS

Electrical and mechanical engineering joined in this Hi-Voltage Switch to produce the one new air break development in 5 years.

The totally enclosed bronze Mechanism is mounted in monel ball bearings and graphite insert bearings.

So dependable and positive in operation, this Switch will outlive the structure upon which it is mounted.



*Type S-W*
*Voltages to 34.5 K. V.*

*Write for Bulletin*
*No. 26*

**HI-VOLTAGE EQUIPMENT CO.**

2891 EAST 79TH ST., CLEVELAND, OHIO

the past few years while he was away from the electrical trade his varied and energetic activity as general sales manager of the Dirigold Corporation and as sales manager of the Air Control Systems, Inc., has given him a new and vital approach to the lighting field.

▶ RALPH WILKERSON, formerly with the Interstate Power Company in Cushing, Okla., has been transferred to Lancaster, Wis., as manager for Interstate Power in that city.

▶ L. M. GROW, formerly electrical engineer for the Central Ohio Light & Power Company, Wooster, has been appointed to a similar position with the Southwestern Public Service Company, Amarillo, Tex.

▶ E. F. FEELY, representative of the International Nickel Company in South America, and J. S. VANICK, a member of the development and research division, are visiting several South American countries within the next few months in order to offer consultation service to industrial executives and engineers on problems involved in the production and application of nickel alloys. Both men are metallurgists and qualified by training and experience to provide valuable assistance in an advisory capacity.

## N. W. Storer Retires

N. W. Storer, internationally known for his contributions to major railroad electrification projects, has retired after 45 years service with the Westinghouse Electric & Manufacturing Company. At the time of his retirement he was consulting railway engineer of the company.

Among electrification projects in which he was active were the New York, New Haven & Hartford Railway, Pennsylvania Railroad, St. Clair and Hoosac Tunnels, Chicago, Milwaukee & St. Paul and the Great Northern. His latest contribution to transportation problems was the design of a bi-way system of continuous trains to provide mass transportation in congested areas.

His memberships identify him with the leading technical organizations of his profession. He was manager of the A.I.E.E. from 1911 to 1914 and served two terms as vice-president of that organization. He has been a member of the International Electrotechnical Commission since 1920. At his retirement he was tendered a testimonial dinner at which the principal speaker was President F. A. Merrick of Westinghouse.

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▶ J. A. MILLS, New York lawyer and native of Lebanon, Ky., has been appointed general counsel to the Air Conditioning Manufacturers' Association and the Refrigerating Machinery Association. Mr. Mills has had broad legal experience, particularly in the refrigerating and air-conditioning fields.

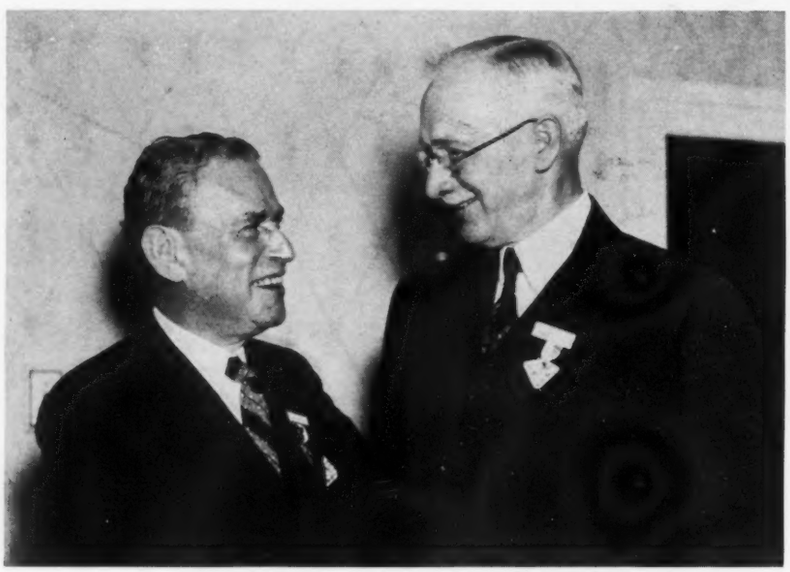
▶ ARTHUR CUNNINGTON has been elected president of the British Illuminating Engineering Society. Mr. Cunnington is a lighting and heating engineer of the Southern Railway.

▶ GEORGE L. KNIGHT, vice-president in charge of mechanical operations of the Brooklyn Edison Company, has been re-elected president of the United Engineering Trustees, Inc., joint agency of the four Founder Engineering Societies. Otis E. Hovey, consulting engineer, New York, and D. Robert Yarnall, chief engineer of Yarnall-Waring Company, Philadelphia, were named vice-presidents.

▶ F. S. PARTRIDGE, formerly special construction superintendent for the Byllesby Engineering & Management Corporation in Oklahoma City, has been transferred to the Oklahoma Gas & Electric Company as construction superintendent. Mr. Partridge will be in charge of all construction work, as well as heavy maintenance, both electrical and mechanical.

▶ C. J. FECHHEIMER has recently joined the engineering staff of the Louis Allis Company, Milwaukee, in the capacity of consulting engineer. For more than twenty years Mr. Fechheimer has been closely associated with the electrical manufacturing industry, as designing engineer and research engineer. As a nationally known author and lecturer on both electrical and mechanical subjects, as

## HOST GREETS VISITING COMMISSIONER



**President Harry Bacharach (left) New Jersey Public Utility Commission, welcomes President Thomas E. McKay of the National Association of Railroad and Utilities Commissioners to Atlantic City. Mr. McKay, a Utah commissioner, has been filling the unexpired term of Frank Morgan of the Alabama commission as president of the association. He has just been elected to a full term**

FLEET OPERATORS HAVE PROVED IT!

# YOU *Can* AFFORD TO USE *Gulfpride Oil* IN YOUR CARS AND TRUCKS

**Just one of the many steps Gulf Scientists take to insure the high service value of *Gulfpride Oil***



An 8-cylinder automotive engine on the test dynamometer to determine the wear-life, horsepower output, carbon formation and friction losses due to differences in characteristics of motor oils.

## Operating cost figures prove that it's far cheaper to use *Gulfpride*.. the World's finest Motor Oil (100% Pure Pennsylvania)

Gulfpride is the only motor oil in the world refined by the "Alchlor Process." This famous process *literally* starts where others leave off. By removing the trouble-making impurities left in motor oil by less effective refining methods, the Alchlor Process produces an oil which has no equal.

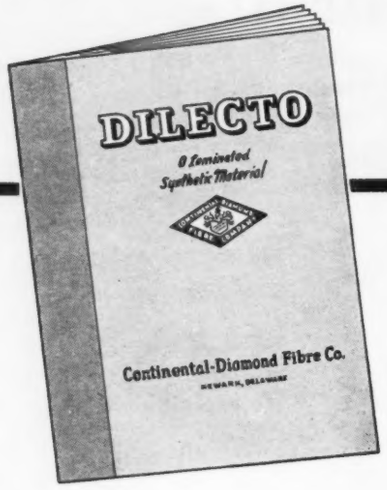
Trucks and commercial cars operate with far less expense when Gulfpride is used. Here is a typical statement—from a man in charge of a large fleet of trucks: "Our maintenance costs this year—with Gulfpride in service—have been less than half our former costs. We seldom need to add oil between drains—which are less frequent than before. Gulfpride has *more than paid for itself* in our equipment."

You *can* afford to use Gulfpride Oil—because it costs less to use! More per gallon—but less per mile.

**GULF OIL CORPORATION**
**GULF REFINING COMPANY**

GULF

GENERAL OFFICES, GULF BUILDING, PITTSBURGH, PA.




A

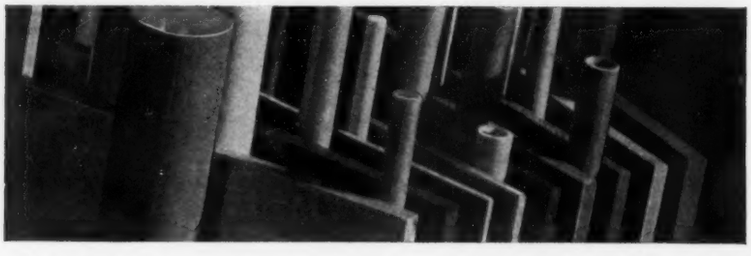
BOOK

*you will want to*

*keep at your elbow*

The DILECTO catalog will help you answer the question "What insulating material shall we use?"! It not only contains complete technical data, information about many of its countless uses, and helpful suggestions for fabricating, but also gives complete comparative properties of DILECTO—VULCANIZED FIBRE, and VULCOID, all Continental-Diamond products and other insulating materials.

You will find this book extremely helpful no matter what insulating material you now use. Send for your copy today.



**CONTINENTAL-DIAMOND FIBRE COMPANY**

**NEWARK, DELAWARE**


well as an inventor, he has personally contributed substantially to the advancement of the electrical industry. His work on self-starting synchronous motors and on heat problems in electrical apparatus are among his contributions. For the past five years Mr. Fechheimer has been engaged as a consultant in private practice.

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## OBITUARY

▶ REVELLE C. URQUHART, president of the Power Equipment Company, Inc., St. Louis, Mo., died, of a heart attack, on October 4 at his home in University City, Mo., in his forty-ninth year. Mr. Urquhart organized the Power Equipment Company in 1929.

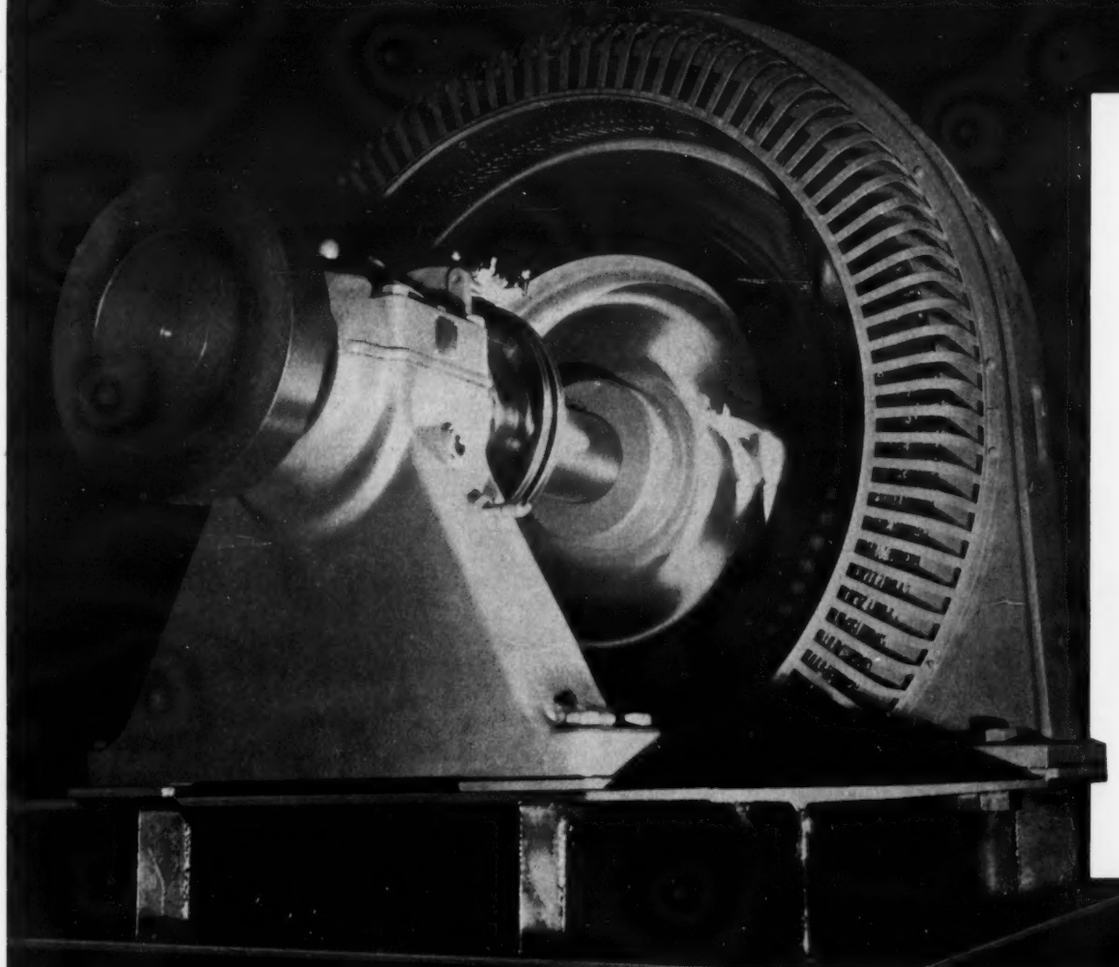
▶ FRANKLIN OVERBAGH, a pioneer in the electrical industry, died October 6 in Evanston, Ill.. in his eighty-third year. Until four years before his death Mr. Overbagh was active in the management of the Overbagh & Ayres Company, manufacturer of electric reflectors, which he founded in 1902. He was a charter member of the Electrical Trades Association of Chicago and was general secretary of the National Electrical Wholesalers Association from 1908 to 1928.

▶ WALTER RUTHERFORD, a founder and vice-president of the British Electrical and Allied Manufacturers' Association, died recently in London at the age of 66. Mr. Rutherford was well-known throughout the electrical world.

▶ FREDERICK PALMER, vice-president of the Triangle Conduit & Cable Company, Inc., Brooklyn, N. Y., died November 9 at the Caledonian Hospital, Brooklyn, following an operation. Mr. Palmer had been identified with the Triangle Company since its formation in 1916, and was appointed in August of this year to the position of vice-president in charge of production. Mr. Palmer was well known in the utility field as well as in the electrical manufacturing industry.

▶ FREDERICK W. SANFORD, an executive of the General Electric Company, died November 4 at the New York Hospital, in his seventieth year. After graduation from Williams College in 1889 Mr. Sanford entered the employ of the New York Edison Company as an electrical engineer. He resigned

# USS AMERICAN ELECTRICAL SHEETS...



. . . made and sold by Carnegie-Illinois, are the best electrical sheets—grade for grade—that metallurgical skill plus electrical research can produce.

Our engineers control their composition and manufacture in order to give you sheets that punch easily, lengthen die life, stack readily, offer maximum permeability, highest space factor, minimum core losses—the optimum combination of properties consistent with the requirements of each grade.

All sheets are not alike. With these better sheets plus our competent technical service, you can increase electrical efficiency, reduce production costs. Write us today for facts and figures.

CARNEGIE-ILLINOIS STEEL CORPORATION

*Pittsburgh and Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Products Company, New York, *Export Distributors*

This 250 Hp., 277 Rpm. Tork-Rite synchronous motor for heavy flour-mill duty was built by the Electrical Machinery Manufacturing Co. of Minneapolis. To insure maximum electrical efficiency, they use American Electrical Sheets.

UNITED STATES STEEL

"*. . . very satisfactory results*"

**"The MEG GROUND TESTER has given us very satisfactory results . . . We have tested all our grounded dead metal parts and also the steel poles in our yards, and we feel that the results obtained were very close to correct."**

THE above—from a Safety Engineer—indicates the importance of measuring ground resistance for protection to life and property wherever electrical equipment is in operation. Our "Megger" and "Meg" Ground Testers are in general use among Power Companies, Industrial Plants, Railroads and Telephone and Telegraph Companies. Write for Catalog 1425-W.

**JAMES G. BIDDLE CO.**

ELECTRICAL INSTRUMENTS

ARCH STREET PHILADELPHIA, PA.

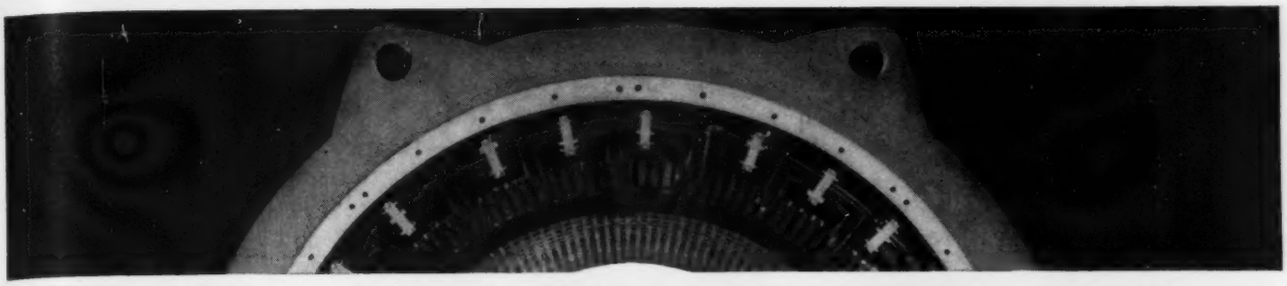

in 1902 to join the Stanley Instrument Company of Great Barrington, Mass. On its merger with the General Electric Company in 1908 he became an executive of the incandescent lamp division, the position he held at the time of his death.

▶BENJAMIN H. SCRANTON, chairman of the board of directors of the American Electrical Heater Company, manufacturer of electrical appliances, with headquarters in Detroit, died November 8 of a heart attack in Scarsdale, N. Y. He was 80 years of age.

▶ROBERT W. MITCHELL, assistant to the president of the United Electric Light Company, Springfield, Mass., formerly its general manager, and long identified with the development of the Western Massachusetts Companies' group in the central Connecticut Valley, died at Springfield on October 29 at the age of 53. He was active in power sales work for the Turners Falls Power & Electric Company in earlier days, and had served as public relations manager of the Western Massachusetts Companies as well as manager of the Agawam and Ludlow companies of the group.

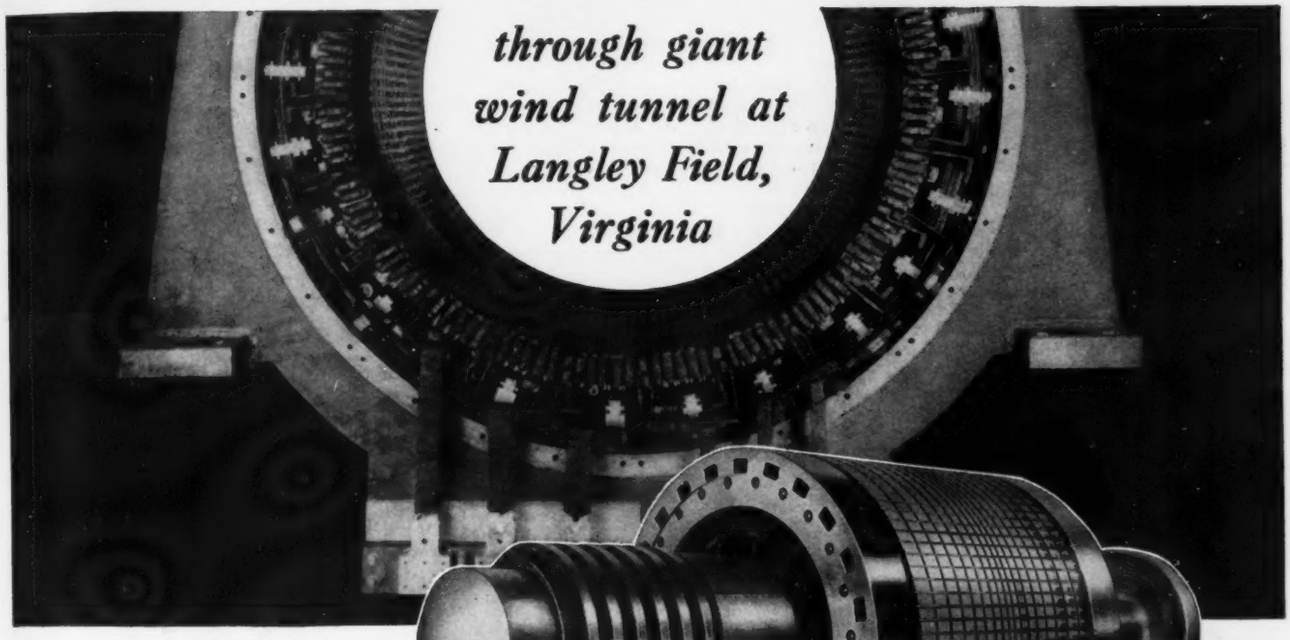
▶THOMAS E. PENARD, for the past five years assistant superintendent of the station engineering department of the Boston Edison Company, died at the Cambridge City Hospital on Oct. 27 following a shock. He was born in Dutch Guiana in 1878; was graduated from the Massachusetts Institute of Technology in 1900, and had been with the company since 1901, having had an active part in the design of its electrical installations. For a time Mr. Penard was dean of the evening school of Northeastern University.

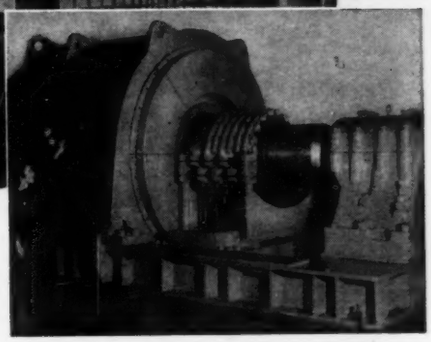
▶JAMES A. HALL, professor of mechanical engineering at Brown University, consulting engineer of the Brown & Sharpe Manufacturing Company, Providence, R. I., and a past president of the Providence Engineering Society, died at the Jane Brown Hospital in that city October 29 after a month's illness. He was born in Berlin, Vt., in 1888, and had been connected with Brown since 1910. For a time in 1914–5 he was assistant engineer of the Link-Belt Company at Philadelphia. Prof. Hall was widely known in the utility field and was a contributor to many engineering publications.



# DRIVES A 500 MILE AN HOUR GALE—

*through giant wind tunnel at Langley Field, Virginia*





## *50 Ton Induction Motor develops 8000 Horsepower*

THIS huge 50-ton motor — the driving power for a new "full speed" wind tunnel used by the National Advisory Committee for Aeronautics to conduct scientific research in aeronautics — was recently installed at its laboratories at Langley Field, Virginia. Solidly coupled to a fan shaft, with an 18 blade fan, this motor, at its maximum, delivers a 500 mile an hour wind at the test chamber.

The Magnet Wire used in its construction was furnished by the American Steel & Wire Company — specialists in the making of Magnet Wire — of every type and grade — and of Electrical Wires and Cables for all uses.

### INTERESTING FACTS ABOUT THIS UNUSUAL MOTOR

**Made by the Crocker Wheeler Electric Manufacturing Company, Ampere, New Jersey — develops 8000 H.P.— and its base measures 115" wide and 190¼" long.**

# U·S·S MAGNET WIRE

AMERICAN STEEL & WIRE COMPANY

208 S. La Salle Street, Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

Empire State Building, New York

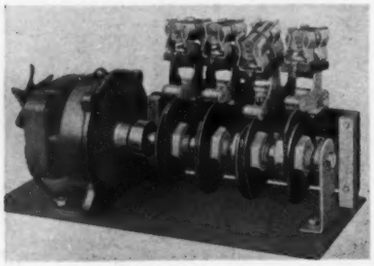
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

# New EQUIPMENT AVAILABLE

## Time Cycle Controllers

Controllers designed for industrial work such as cycling operations on machine tools and control valves, as well as for sign flashers, are being marketed. A motor drives a camshaft through a speed reducer



Model 602, to control three to eight circuits; cycling speeds, 1, 2, 3, 4, 5, 10, 15 or 20 b.p.m.; Model 611, not shown, to control one or two circuits, cycling speeds, 15, 30, 45 and 60 b.p.m.; both models operate on 110-volt, 60-cycle a.c., maximum load per circuit, 1,650 watts. **Electric Switch Corporation,** Columbus, Ind.

and a set of gears. Cams operate rocker mechanisms which tilt special mercury switches, causing the load circuits to be closed or opened. Cams are made of bakelite and in adjustable sections, so that the load circuits may be opened or closed at any point of the cycle.

•

## Pole Trailer

On this new model the entire load of poles is carried on the trailer, eliminating the necessity for a special truck with a bolster on the truck bed. Trailer, with its load of

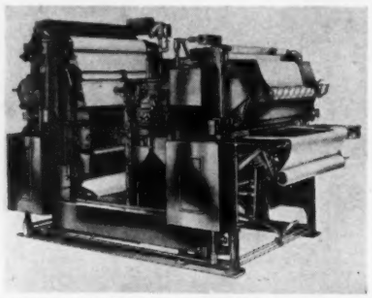
Types MP and HP; rated 3-4 and 5-6 tons, respectively; dual standard pneumatic tires and power brakes optional. **Highway Trailer Co.,** Edgerton, Wis.

poles, may be hauled by truck equipped with any type of line construction body. Wide double channel bolsters are provided with sliding cam-locking stanchions adjustable to suit the width of load. A load-binding winch is mounted on the rear bolster.

•

## Blue-Printing Machines

Two continuous blue-printing, washing and drying machines, differing chiefly in the character and construction of drying equipment, have been announced. Both types are said to be easy to feed and to run; tracings and paper are fed in together at the front of the machine. Traveling upward, they pass around a curved segment of highly polished glass where thorough exposure is accomplished by means of a series of high-power inclosed arc lamps. After exposure, when running cut sheet sizes, prints and tracings are both returned into the tray for separate hand washing, developing and hand



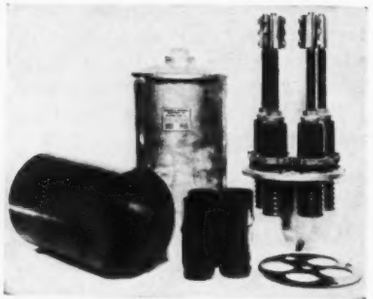
Model "27-D"; with double drum ironing type drier; Model "27," not shown, with radiator type drier; handle all widths of sensitized cloth or paper up to either 42 in. or 54 in.; gas or electrically heated driers available; production speed from 8 in. to 14 ft. per minute. **C. F. Pease Co.,** Chicago, Ill.

drying—but when running continuously, tracings only are returned, while the prints go forward to be washed and dried electrically.

•

## Cable Terminal

Space saving, simplicity and ease of installation are advantages claimed for this new style of cable terminal. Metal base of the device has an entrance for a multiple-conductor lead sheath cable and carries suitably insulated studs to which the cable



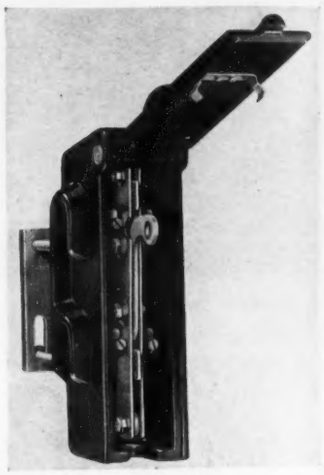
Available for voltages up to 7,500 and for three- and four-conductor cables up to and including 500,000 circ.mil. **Electrical Engineers Equipment Co.,** Melrose Park, Ill.

conductors are attached. Studs project through the base and form terminals which are insulated with inverted porcelain bushings, and, together with the conductors connected to them, are insulated by bakelite tubes. The entire assembly is surrounded by a larger tube of the same material. Outside housing is bronze. The assembled unit is filled with insulating compound.

•

## Disconnect Switch

Swift action, safe, convenient operation and long, dependable service are promised for this porcelain-inclosed disconnecting switch. It has a "dead hinge" type blade



Catalog No. C-353003-1; 7,500 volts, 400 amp. **Line Material Co.,** South Milwaukee, Wis.

for safety, a large protruding pull ring for easy operation and cam action blades for quick action. This is stated to be the first switch of its type that can be operated with a standard switch stick. It is equipped with an adjustable cross-arm hanger.

•

## Explosion-Tested Motors

Type SK; available in sizes from 5 to 75 hp. and 115, 230 and 550 volts d.c. **Westinghouse Electric & Manufacturing Co.,** East Pittsburgh, Pa.

A new and improved design of these explosion-tested, fan-cooled, totally inclosed, direct-current motors, designed for use in locations where explosive gases or dust may collect, has been announced. Brushes and commutator are readily accessible and motor is designed with the fan on the commutator, so arranged that a gear case, coupling or pulley will not restrict ventilation. Accessibility is obtained by use of a double-walled bracket on the commutation end. This bracket is equipped with hand-hole covers, removable to permit inspection and adjustment of brushes and commutators.

# LINEMEN LIKE NITEWORK?

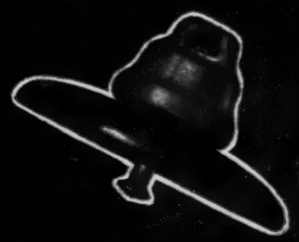
NO MORE than the rest of us. Daytime is their time to work too, if you expect their best efforts. • You serve yourself when you help them by buying recognized products and eliminating expensive middle-of-the-night service trips. • One way to do away with these unexpected service interruptions is to

*"Specify Porcelain Products!"*

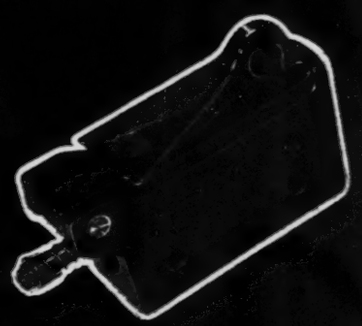
**PORCELAIN PRODUCTS, INC.**
PARKERSBURG • WEST VIRGINIA

*THEY LIKE THESE PRODUCTS

*EASY TO HANDLE

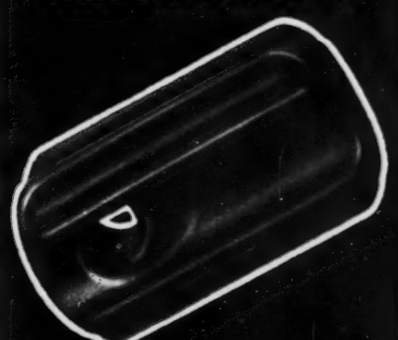


*THEY GO UP TO STAY



*YOU'LL LIKE THEM TOO

*THEY MEAN SAVING



*LOWER LINE LOSSES

*LESS FREQUENT REPLACEMENT

## Range and Lighting Cabinet

It is said to be impossible to interchange the range switch (with its lower fusing) for the main switch (with its higher fusing) in this compact, all-Bakelite, main service range and lighting cabinet. Flexible neutral bar

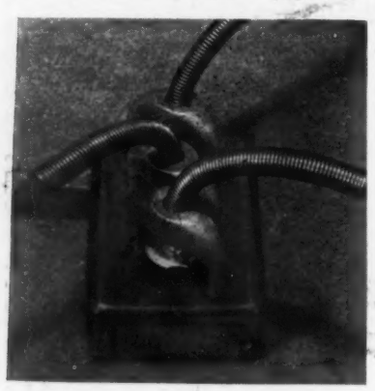
Catalog No. 551204B; capacity, one 60-amp., 3-pole solid neutral main switch, one 60-amp., 3-pole solid neutral range switch, four 30-amp., plug fuse circuits for lighting and one 60-amp. subfeed for water heater or similar circuit. **Bull Dog Electric Products Co.**, Detroit, Mich.

permits connection of the switches at the top or bottom as desired, and both switches are inverted for the "off" position. The additional wiring room provided in the cabinet precludes the necessity for removing the unit for wiring.

•

## Extension Cord Twist Yoke

Said to be of particular service for use with hand tools or portable equipment, this



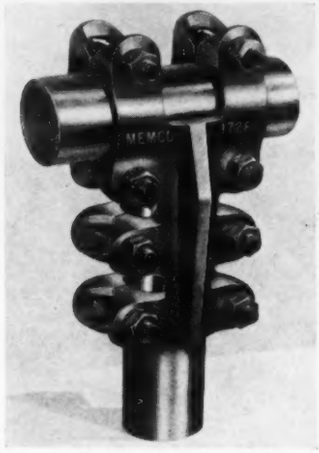
Adaptable to any standard outlet box; distributed by **Logan Sales Co.**, Los Angeles, Calif.

twist yoke is designed to assure permanent connection for all types of extension cord caps. A slight turn secures the locking pins in the countersunk holes; a rubber gasket under the outlet cover guards against dirt shorting the contact.

•

## Copper Tee Connectors

Accurate inside contour of these connectors combined with the pliability provided by interconnected clamping bands is said to make a connector-to-bus contact having a minimum potential drop and a low tempera-



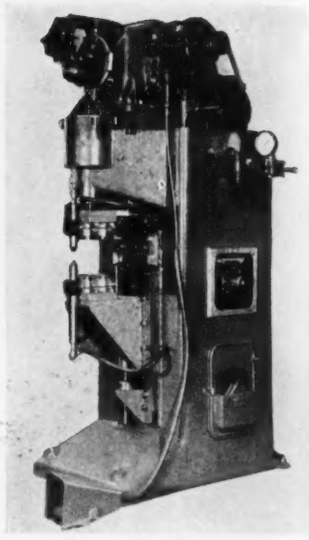
Senior "Pli-A-Band"; connecting tubing to tubing, tubing to cable, cable to cable; obtainable in all standard sizes, special models will be developed by company. **Memco Engineering & Manufacturing Co., Inc.**, Long Island City, N. Y.

ture rise. Connectors are made of a resilient copper alloy combining strength with conductivity; deep ribs and careful distribution of metal insure maximum mechanical and electrical efficiency, it is claimed. One wrench only is required for their installation.

•

## Resistance Welder

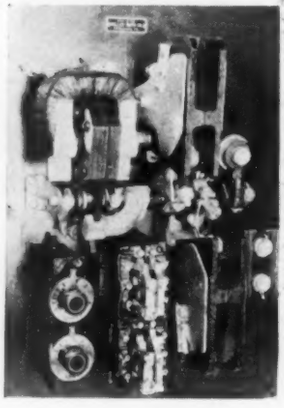
Several new features are incorporated in this standard press welder. Speeds of from 12 to 100 welding strokes per minute are provided by an 8 to 1 reduction unit, which is driven by a motor through a double V-belt. Mounted on the main shaft of the reducing unit, directly over the pressure head, is an eccentric, by means of which the stroke may be adjusted from 0 to 4 inches. A special lower knee or arm is adjustable up or down within a range of 6 inches. Surfaces of the lower and upper arms are de-

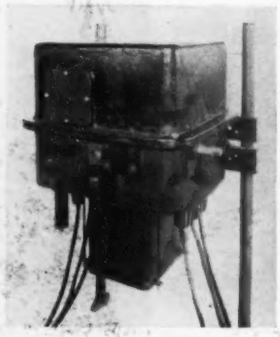


Model 212; devices can be used on entire line of No. 2 welding presses. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

signed to hold projection welding electrodes directly under the spindle or to hold terminal blocks for standard water-cooled spot-welding electrodes. Air gage helps regulate pressures in 8-inch diameter air cushion chamber.

## Step Capacitor Regulator





Type REC. Separate control assembly (left), capacitor and switch assembly (right). **Roller Smith Co.**, New York.

By introducing shunt capacity to raise power factor and so increase line voltage, a newly developed step capacitor regulator produces a voltage boost, both before and after its point of installation on the line. As line voltage decreases to a predetermined value a voltage-sensitive network in the regulator operates relays that actuate a solenoid-operated oil switch connecting the capacitors to the line. The capacitors are removed from the line as voltage reaches the proper value above normal.

## ENGINEERING DATA FROM MANUFACTURERS

**Bulletins and catalogs now available to engineers by manufacturers and associations**

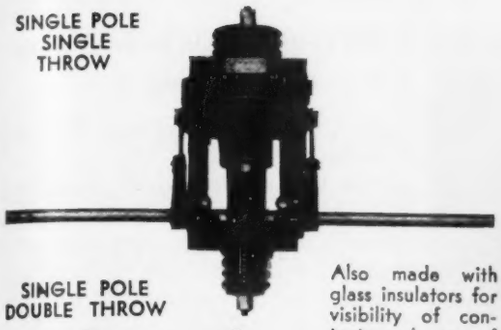
STEAM FLOW MEASUREMENT—The revised Second Edition of the "Handbook of Steam Flow Measurement," by L. K. Spink, has been issued by the Foxboro Company, Foxboro, Mass. Two methods of computations are discussed; one covers those applications where pressure and temperature are constant, the other, those in which the pressure varies widely. Various formulas, charts, tables and pictures of steam flow measuring devices are embodied in this 72-page booklet.

INCLOSED FAN-COOLED MOTORS—A folder recently published by the Lincoln Electric Company, Cleveland, Ohio, gives engineering pointers on the selection, application and installation on enclosed, fan-cooled motors of the "Linc-Weld" Type E line. Bases, pulleys, dimensions and prices are listed; diagrams and pictures show the motor design.

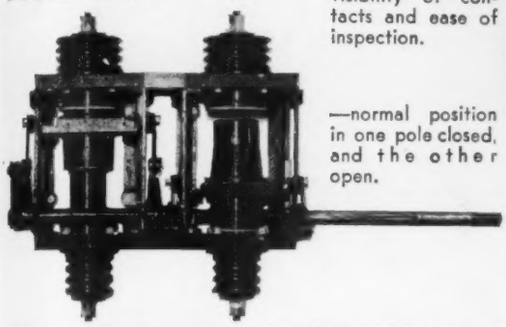
DISTRIBUTION TRANSFORMERS — Leaflet 2172A of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., describes and illustrates outage-free high-voltage distribution transformers, type CB, developed for use in rural electrification. Construction details are pictured and discussed in some detail, and a chart indicates the transient voltage distribution in the transformer windings. Outdoor type current transformers for pole top and substation installation are described in leaflet No. 2227, of the same company.

STEAM TURBINE UNITS — Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued a 36-page bulletin, No. 1179, covering that company's line of condensing, automatic-extraction turbine frames for the capacity range of 500 through 5,000 kw. Installation photographs and sectional views are shown for each frame. Turbo-alternator construction is described in another section.

SINGLE POLE
SINGLE
THROW



SINGLE POLE
DOUBLE THROW



Also made with glass insulators for visibility of contacts and ease of inspection.

—normal position in one pole closed, and the other open.

# "THREE E" TELESCOPING ISOLATORS *– any desired combination*

## *for* DISCONNECTING ELECTRICAL POWER CIRCUITS . . . .

***This NEW, dependable and cost saving device***

is backed by 25 years of sound, practical, and advanced engineering. "Three E" specialists have worked in the field and have constantly maintained a close contact with the industry and its operating problems. Constant development work is going on in the large "Three E" plant—here these experts visualize and plan, always considering the greater service of electrical apparatus with more economical operation and upkeep.

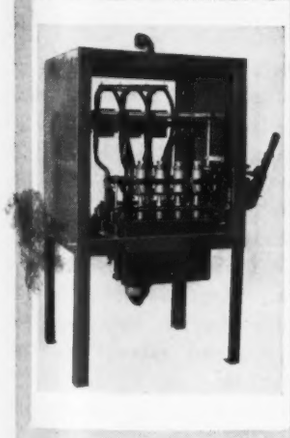
★

## *Saves space—*

### Operates equally well in any required position–installed at low cost–

This new, safe, compact device provides a dependable disconnecting device by use of telescoping contacts enclosed in telescoping insulating bushings. They can be supplied for practically any kind of installation. Furnished for assembly with oil circuit breaker studs, transformer bushings, etc. Simple and economical arrangements effected in every case. Operators and workmen are never in danger of accidental contact because all live parts are enclosed in insulation both when isolator is closed or open. Any desired combination of single pole units, single or double throw can be made. In sizes up to 2000 amperes at 15,000 volts. Send for Bulletin No. 131.

**ELECTRICAL ENGINEERS EQUIPMENT CO.**
**MELROSE PARK, ILL.**



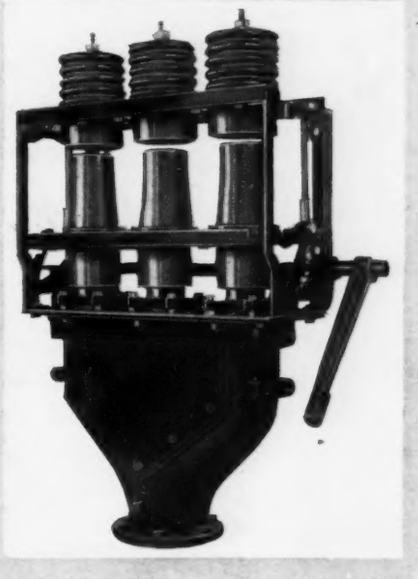
An 8 Pole Type A Form-2 isolator installed in metal cabinet and operating directly on top of bushings of 4 Pole, single throw oil circuit breaker. The isolator is operated from the front of the cabinet beside the oil circuit breaker operating handle. It can therefore be readily interlocked with the circuit breaker..

With the isolator in open position the oil circuit breaker is entirely disconnected from the electrical system. Glass window in one removable side of cabinet provides visibility from outside.

**"Three E" Cable Isolator**

A "Three E" Telescoping Isolator combined with an END BELL for all services.

The use of the cable isolator gives a disconnecting type cable end bell, and furthermore, a gang operated disconnecting cable end bell wherein the circuit is opened or closed with one operation. No dummy caps or tubes, to complicate operation are necessary. This combination provides a highly flexible device for terminating and disconnecting lead covered power cables.



# "THREE E"
## HIGH QUALITY
## LINE AND STATION EQUIPMENT

THINGS TO DO TODAY
Send for New Rockbestos Catalog! Shows complete line of asbestos insulated wires, cables and cords, made to new standard specifications. Write Rockbestos Products Corp., 835 Nicoll St., New Haven, Ct., giving:
name
title
company
address

*Fill in, tear off coupon and mail today*

## 46 Years With Bare Neutral

[*Continued from page 43*]

tion to rentable stores and office space on the lower floors.

In the original wiring installation the bare neutral cables were pulled into 3/8-in. and 1/2-in. varnished rolled paper or fiber ducts. These were buried in the plaster for concealed work in finished rooms. Where exposed wiring was run in the elevator shaft, basement and attic the conduits were fastened to the wall with strip brass straps.

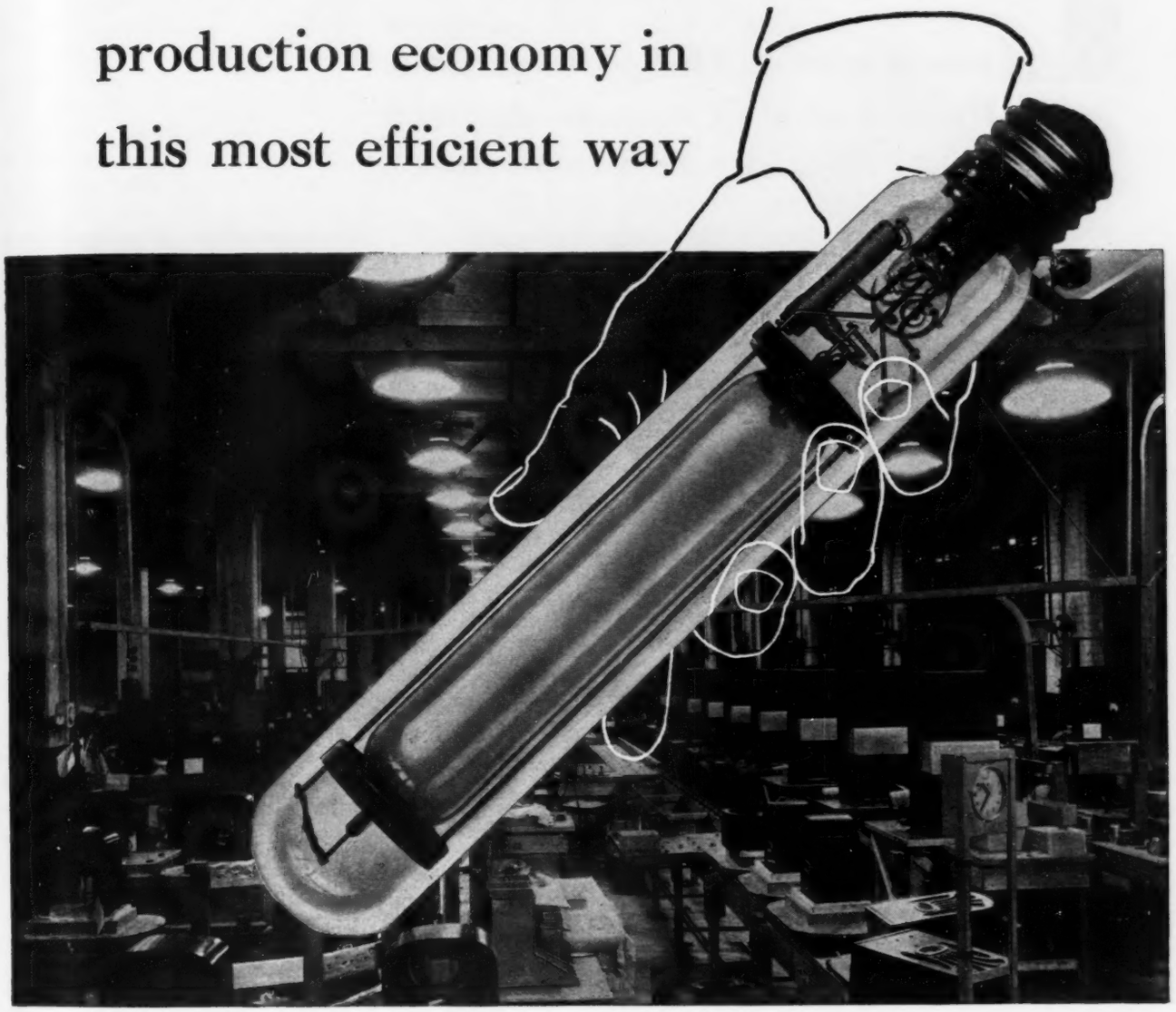
Extensive rewiring has been carried on during the past decade in connection with a program of redecorating and refinishing the interior of the building. Much of the bare neutral

**Bare neutral cable in varnished paper or fiber duct buried in plaster feeds a wall bracket**

wiring has thus been removed, but two floors of the building still receive their electric service largely through these circuits. An interesting feature of the job is that several of the fuse cutout cabinets installed in 1891 are still giving satisfactory service, together with the old brush type Edison General Electric Company snap switches, which are rated at "10 lights" each.

The No. 14, two-conductor bare neutral cable itself closely resembles the modern styles which have just been approved by Underwriters' Laboratories for trial installation purposes. One interesting feature of the assembly is that the inner insulated conductor is stranded instead of solid. The rubber insulation has, of course, deteriorated, but the outer braid is in excellent condition. The most significant point, however, is that here is a wiring installation that was installed 46 years ago without the benefit of our modern highly detailed rules and

# Throw more light on production economy in this most efficient way



*A typical installation of General Electric Mercury Lamps in a well-known machine shop.*

Throughout industry higher levels of illumination are being obtained, at a lower cost per foot-candle, by means of General Electric Mercury Lamps. These modern, efficient sources of light are promoting more economical, more efficient production everywhere. With the higher levels of illumination, rejects are minimized . . . there is no waste of energy in the mere physical act of "seeing" . . . and eye-strain is reduced materially. As a result, end-of-shift fatigue is banished and workmen can produce a more uniform, accurately finished product at lower cost.

General Electric Mercury Lamps are available in two sizes—400 watts and 250 watts. Both are adapted for use on 115- or 230-volt lines, and both have a rated life of 2,000 hours. These lamps have an efficiency 50 to 100% higher than that of other light sources.

For complete details address . . .

*Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.*

**GENERAL ELECTRIC**

751H

General Electric Vapor Lamp Co.
805 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Nela Park, Cleveland, Ohio

# Learn about the plus values that AmerTran builds into Distribution Transformers

**AMERTRAN DISTRIBUTION TRANSFORMERS**

**Pole, Platform, Subway and Vault types**

●

**Sizes to 500 Kva.**

●

**Potentials to 73000 V.**

●

**Single or three phase**

●

**60 or 25 cycles**

●

**55° C. Rise**

*AmerTran Type CC distribution transformer rated 333 Kva., single-phase, 60 cycle, 6900 volts to 115/230 volts.*

**AMERTRAN PRODUCTS**

Transformers:
- Power
- Distribution
- Instrument
- Furnace
- Precipitator
- Air-cooled
- Testing
- Welding
- Audio-frequency
- Plate-supply
- Filament-supply
- Special-purpose

Voltage Regulators
Testing Sets
Spot Welders
Rectifiers

**YOU can't select the best transformer from a photograph, but pictures of AmerTran transformers do indicate good workmanship, rugged construction, attractive appearance and careful attention to details. Equal care has been exercised in the design and construction of concealed parts. Coils are wound on laminated, kraft-paper tubes; are provided with ample oil ducts; are vacuum impregnated in varnish. Core laminations of highest quality, non-ageing silicon steel are cut, assembled and clamped so as to have low losses and good mechanical strength. Syphon-proof bushings are of the coordinated type. Transformers are shipped filled with oil of the best grade obtainable.**

*Send for Catalog No. 116*

AMERTRAN

QUALITY TRANSFORMERS SINCE 1901

American Transformer Company Newark N.J. U.S.A.

*Sales Offices: Atlanta Boston Chicago Cleveland Denver Hartford Knoxville Los Angeles Montreal Newark New York Philadelphia Pittsburgh Rochester San Francisco Seattle*


regulations, but is still in active and satisfactory service, although of a type that has been giving the N.F.P.A. electrical committee one of its well-known headaches for some time. The system operated for years with line voltage on both the insulated and the uninsulated conductor, although at the present time this type of construction is not even approved by the National Electrical Code for general use when the uninsulated conductor is at ground potential.

## Lighting the World's Largest Bridge

[*Continued from page 46*]

The 125 relays on the central station control board and the telephone communication and police call lighting system relays will be operated by direct current from a storage battery automatically charged by means of a trickle charger.

Unquestionably the San Francisco-Oakland Bay Bridge will be the best lighted bridge structure in the world and one of the finest examples of modern highway lighting to be found anywhere. Considering the amount of effective illumination placed on the roadways the cost of lighting this 13.7-mile stretch of roadway is surprisingly low. The cost of energy, including the lighting of adjacent streets, is estimated to be approximately $22.000 per year. To this figure must be added the maintenance on the lighting units, the chief item of which is the replacement of the sodium-vapor lamps every six months, the burning life being 2,000 hours. Night visibility is excellent, it being possible to see clearly an automobile at a distance of 2,700 ft. It is anticipated that the effect of this installation not only will speed traffic and reduce accidents but will go far toward educating automobile drivers toward the advantages of highway lighting on an extended scale.

•

## Oil Furnace Prices Cut

General Electric Company has made drastic reductions in the price of its oil furnace, effective October 15. Increased production has enabled General Electric to effect these savings, which it is passing along to the consumers in accordance with its established policy.

THE ARCTIC'S *frigid blasts and icy waters, chill not the Polar Bear—well* protected *by his coat of fur.*

# PROTECTION

JUST as the Polar Bear is protected to fit his environment—so are Chromel heating-elements protected against the destructive oxygen of the air. A thin, dense, tightly clinging coat of oxide forms on Chromel, which is thus protected, somewhat as wood is protected by paint. . . . Thus Chromel is very durable by nature. In our hands it has become even more strikingly durable, through what 30 years of manufacture have taught us. This is one good reason for the fast growing acceptance of electric heat, by your customers. Only the domestic use of Electric Heat now brings to the power companies $132,000,000 annually. And of course, that load is growing as more and more ranges go on your lines. . . . These things are told you to invite your confidence in Chromel, for heating-elements. . . . Send for Catalog K. W.—you'll find it useful. . . . Hoskins Manufacturing Company, Detroit, Michigan.

HOSKINS

# CHROMEL

THE *wire* THAT MADE ELECTRIC HEAT POSSIBLE

**The Sauter, World Famous, Quality Time Switches are now competitive in price with other leading makes.**

**Over twenty-five years of specialized time switch experience together with a well earned reputation in the field is your assurance that Sauters are the best that money can buy.**

***WRITE NOW!...***
***for prices and detail information***

**R. W. CRAMER & COMPANY Inc.**
**67-69 IRVING PLACE · NEW YORK, N.Y.**

## "Electricooks"— A New Load Builder

[*Continued from page 47*]

the dealers have taken hold strongly, and in 1935 they made about half the total sales. Probably the record of 1936 will show the dealers in even higher proportion. To see this condition clearly an understanding of the company's general merchandising policy is necessary.

Depending on where you ask the question and to whom you address it, you get the answer that Detroit Edison does or does not merchandise appliances. In its suburban and rural districts, wherever dealer coverage of the market is lacking, the company does merchandise—vigorously. But in the metropolitan area, where dealers are many and active, the company stimulates and encourages dealer business by promotion and advertising and by refraining from the active merchandising of accepted appliances. In its customer offices the company displays all kinds of electrical goods and people can buy flatirons and toasters there if they want to, but no effort is made to sell them. However, sales effort, well planned and persistent, is made on new appliances for which the market must be developed and on ranges and water heaters, which have not yet found adequate outlet through dealer sales. Coincident with direct and vigorous selling by the company of new devices, the policy of dealer encouragement and assistance on the same appliances is continued. And that the dealers make themselves no small sales factor even in regard to such new things as the electricook is proved by the record.

Thus it was that when your correspondent asked Mr. McLay how many had been sold in 1935, he turned to C. P. Keenan, then present and who heads up the appliance sales division of the company. Mr. Keenan said that he had no exact record because so large a proportion of sales had been made by dealers, but that he guessed the total sales would be pretty close to 20,000 up to the then date (June 1, 1936). This guess is quite well substantiated by later information, which is admittedly incomplete, but which justifies the assured statement that at least 9,000 electricooks were sold in and around Detroit in 1935. In the first five

# THE TRUTH ABOUT MICA

STRENGTH is a basic characteristic of Macallen Mica—dielectric strength that resists high voltages—mechanical strength that fits it for a multitude of uses. Macallen produces Mica—and Mica parts—for every insulation need; in sheets, plates, rings, cloth, tape; and in special forms for every requirement.

Macallen engineers invite you to consult them on any problem involving the use of Mica.

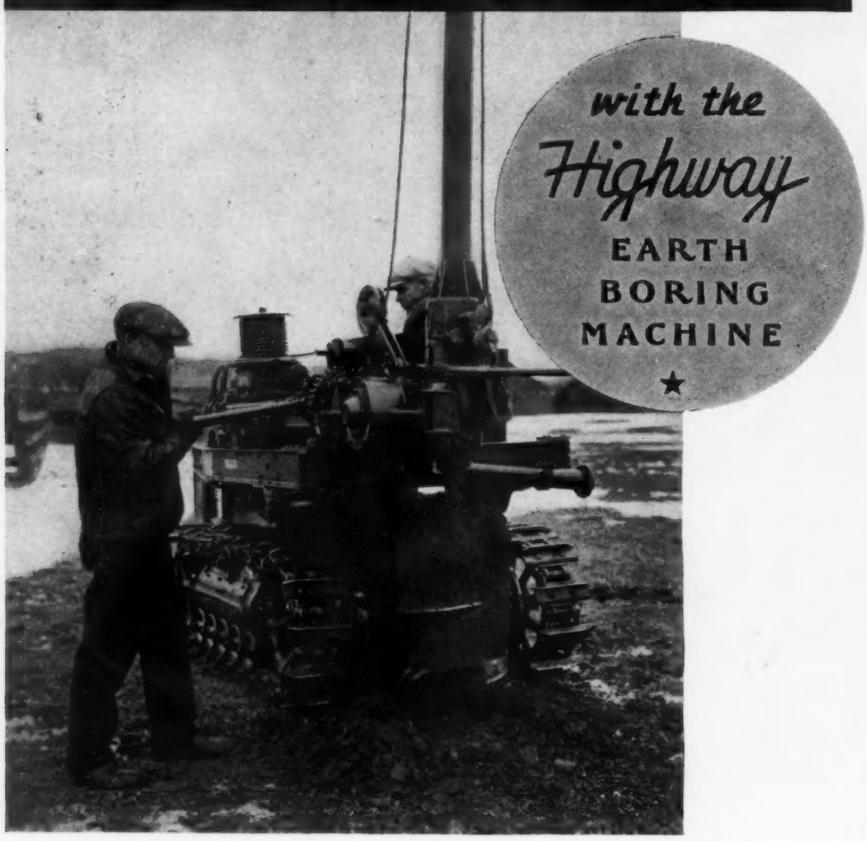
Mica is not a substitute—there is no substitute for Mica as an insulating material. Little affected by moisture, heat or oil.

## THE MACALLEN COMPANY

**16 MACALLEN STREET, BOSTON, MASS.**

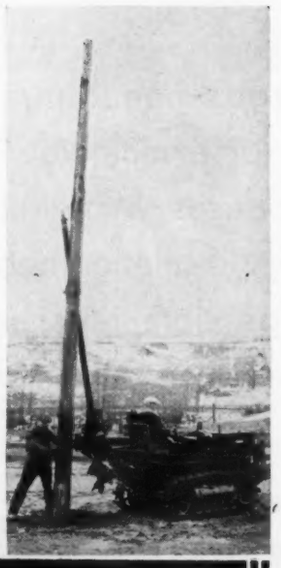
**Chicago, 565 W. Washington Blvd.** **Cleveland, 902 Leader Bldg.**

# DIG THROUGH FROZEN GROUND




## BUILD POWER LINES
### IN WINTER
## AT LOW COST

This dependable tool gives utilities an opportunity to make greater savings than ever before in the cost of setting poles. This is even true in winter time when ground conditions are tough. The Highway reduces the time element in every operation and lightens the amount of manual labor. It adds a higher degree of safety and is of great value in cutting the time for completing new construction programs in any season of the year. With the Highway mounted on truck or tractor you can bore at difficult angles and in hard-to-reach places. There are many types and sizes available. Prepare now for low cost winter line construction with a Highway Earth Boring Machine.



HIGHWAY TRAILER CO.
EDGERTON WISCONSIN


months of this year sales ran close to 4,000. Thus with 4,000 in 1934, with 9,000 in 1935 and with another 4,000 so far this year, and considering that these figures do not completely report the whole story, Mr. Keenan cannot be accused of being too optimistic with his guess of 20,000.

And perhaps Mr. McLay's enthusiastic comparison of the electricook with the flatiron in its service to the customer is rather well justified, too. Looking forward to the end of this year, and thus foreseeing the results of summer, fall and Christmas buying in their proportions to sales so far this year, gives certain support to this belief. Possibly the electricook will turn out to be the first "natural" with which the electrical industry has been blessed since the flatiron. There is a lot of room for argument on this point, but, argument or no, all who have tried it will agree that the electricook is a seller.

## One Breakdown Strength 3 Microseconds to 3 Cycles

[*Continued from page 49*]

is further borne out by the recent data which show that the few-cycle strength of insulation is as high as the impulse strengths of 3 microseconds and longer duration. Until recently, it was thought that the few-cycle strength may be of the same order as the one-second, 60-cycle strength, which is considerably lower than the impulse strength.

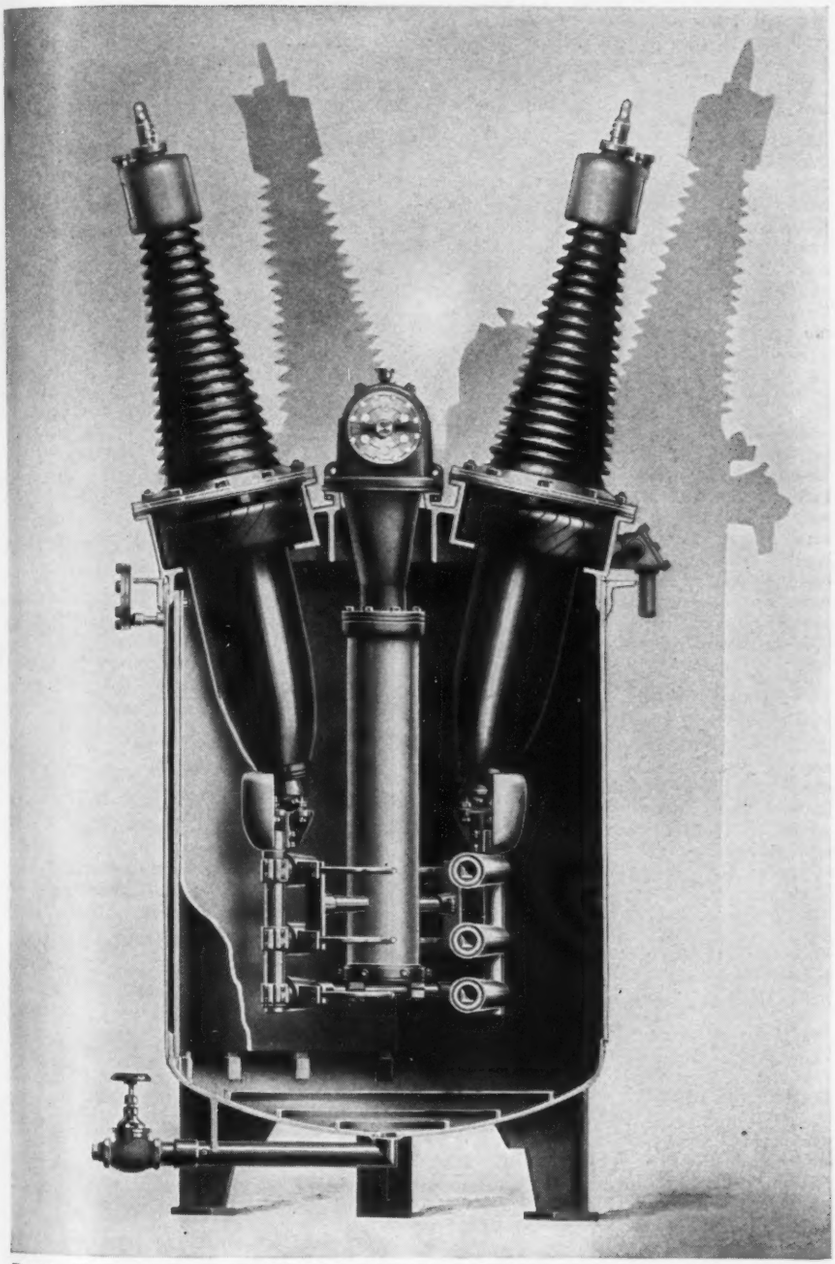
•

## Sales Up One-Third

Sales of electrical goods by wholesalers in September were valued 36.4 per cent higher than a year ago, according to figures announced by the Department of Commerce. Compared with August, there was an increase of 3.7 per cent. These estimates are based on returns from 98 firms whose sales in September were $8,974,000, in the same month last year $6,578,000 and in August $8,657,000. The year's rise in sales of electrical goods was much greater than the rise in sales of all classes of merchandise listed; the latter gained only 17.9%.

Manufacturers' sales of electrical machinery, apparatus and supplies also showed a gain of 36.4 per cent over last year's September, while the increase over August, 1936, was 9.9 per cent, on the basis of $18,653,000 reported by 22 firms.

# Insulation that Stands *Mechanical Stress*



*Pacific Single-Pole, 115KV Oil Circuit Breaker with spindle and Expulsion Chamber sleeves of Bakelite Laminated. Product of Pacific Electric Mfg. Corp., San Francisco, Calif.*

THROUGH use of Bakelite Laminated, electrical manufacturers are now enabled to insure insulation of mechanically-operated equipment that will permit uninterrupted service over longer periods of time, without inspection or servicing. The reason is, that Bakelite Laminated withstands severe mechanical, as well as electrical stress. It possesses high tensile and impact strength, and lasting resistance to change or fracture due to varying temperatures. In addition it is unharmed by immersion in oil or exposure to atmospheric fumes.

An example of the value of Bakelite Laminated in improving mechanically-operated equipment is furnished by the Pacific Expulsion Breaker. For several years, this device has been equipped with a Bakelite Laminated spindle to insure unchanging insulation that will withstand the torque of "making and breaking." With the development of Expulsion Chamber contacting, Bakelite Laminated again contributed dependability, by providing an insulated chamber that stands up under impact and the heat created by this electrical device.

Throughout modern power systems, there are hundreds of other elements or devices that have been similarly improved through use of Bakelite Laminated. Write for our booklet 3L, "Bakelite Laminated" which explain its varied advantages and gives technical data.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

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"The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" in the numerical sign for infinity, or unlimited quantity, it symbolizes the infinite number of present and future uses of Bakelite Corporation's products"

**THE MATERIAL OF A THOUSAND USES**

MEMO

NOTE
MM is the International trade mark of the Leipzig Trade Fairs.

*Put Feb. 28 on your calendar*

This date concerns your business. It marks the 16th annual opening of the Great Engineering and Building Fair at Leipzig, Germany. More than 2,500 firms will exhibit machinery (practically all in operation), equipment and manufacturing processes for every industry. These exhibits fill 17 gigantic building and 10 acres of outdoor space.

Only by covering this Fair (Feb. 28 to Mar. 8), can you know what the whole world offers in your business. You may not be in the market for any machinery or equipment. But you cannot fail to build profits out of the ideas you receive—and the opportunity to meet men in your own line of business from every civilized country of the world. At the same time, you can visit the General Merchandise Fairs (Feb. 28 to Mar. 5)—featuring 6,000 exhibits of finished and semi-finished goods.

Leipzig exhibitors come from 25 countries. More than 230,000 business executives, engineers and buyers from 72 countries inspect the exhibits.

Please write for Booklet No. 18 today. Let us help you determine the profit possibilities for your firm, offered by these Fairs.... Leipzig Trade Fair, Inc., 10 East 40th Street, New York.

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The 2,500 technical exhibits include: —building and construction equipment and sanitary engineering; electrical equipment; iron and steel products, mechanics' tools and materials, semi-finished products; machine tools for metals, wood, glass and similar materials; machinery and apparatus for food, food luxuries, chemical and ceramic industries, packing machines; machinery for textiles, paper and similar products and machinery for the graphic arts; power machinery, heating, foundry and gas fuel engineering; pumps, compressors, transportation and conveying equipment, etc. And probably 500 new inventions.

THE GREAT ENGINEERING AND BUILDING FAIR

A DIVISION OF THE 700-YEAR-OLD

LEIPZIG TRADE FAIRS

## SALES OPPORTUNITIES IN NEW CONSTRUCTION

..WASHINGTON, IOWA—Iowa Southern Utilities Company, Centerville, Iowa, plans extension in transmission line from Washington to Sigourney and vicinity, and new transmission to Wellman, Iowa, and neighboring districts.

GLADSTONE, Mich.—Has called special election December 15 to approve project for municipal electric power plant and bond issue of $100,000 for construction. Shoecraft, Drury & McNamee, Ann Arbor, Mich., are consulting engineers.

ELYRIA, OHIO—Bender Body Company, West Sixty-second Street and Barberton Avenue, Cleveland, Ohio, plans installation of motors and controls, electric hoists, conveyors and other equipment in new automobile body, trailer and school bus manufacturing plant at Elyria, where company has acquired group of buildings on 18-acre tract of land, totaling 500,000 square feet of floor space, formerly held by Willys-Overland Company, Toledo, Ohio, and will modernize and equip for plant. Cost over $150,000.

BUFFALO, N.Y.—Buffalo Sewer Authority, City Hall, Daniel H. McCarriagher, chairman, receives bids until December 8 for electrical equipment and installation for new sewage treatment plant on Bird Island, including power transformers and accessories, high-tension switchgear assembly, starting and control equipment for motors, conduits, wiring, etc. (Division V, estimated cost $84,000); also at same time for six motor-driven vertical shaft centrifugal pumping units, each with rating of 120,000,000 gallons daily (Section IV, estimated cost $250,000).

COLUMBUS, NEB.—Loup River Public Power District, Harold Kramer, secretary, 2307 Thirteenth Street, Columbus, will make surveys and ask bids soon for primary and secondary lines for rural electrification in parts of Platte County, including main transmission line, 165 miles, connecting with new outdoor power substations to be built at Columbus, Fremont, Lincoln, Norfolk, Madison and Seward. Fund of $2,314,000 has been secured through Federal grant and loan. Harza Engineering Company, 205 West Wacker Drive, Chicago, Ill., is consulting engineer.

NEWBERN, TENN.—Has engaged L. O. Brayton Engineering Company, Dyersburg, Tenn., consulting engineer, to make surveys and plans for proposed municipal electrical distribution system, for which fund of $105,400 has been authorized, secured in part through Federal aid. Project will include outdoor power substation with transmission line for connection with high-tension system of TVA for power supply. Bids will be asked soon.

FALL RIVER, MASS.—Celanese Corporation of America, Inc., 180 Madison Avenue, New York, N.Y., plans installation of motors and controls, regulators, transformers and accessories, conveyors and other equipment in new multi-unit rayon mill at Fall River, where two former textile mills of American Printing Company and American Linen Company have been purchased. New units will be built and present structures modernized. Cost about $750,000.

PIQUA, OHIO—Acting jointly with Troy, Ohio, will take bids soon for transmission line to connect the two municipalities, including power substation and switching facilities. Fund of $34,600 has been secured through Federal aid.

SAVANNAH, MO.—Andrew County Consumers Co-Operative, Inc., Savannah, Wayne Sandade, secretary, recently organized, has surveys under way and takes bids at early date for transmission and distributing lines for rural electrification in part of Andrew County, totaling about 180 miles, with power substation and service facilities. Fund of $195,000 has been secured through Federal aid. M. B. Messler, Hannibal, Mo., is consulting engineer.

DOWAGIAC, MICH.—Will take bids soon for extensions and improvements in city-owned electric power plant, including installation of new turbo-generator unit and auxiliary equipment. Cost about $200,000. Ayres, Lewis, Norris & May, Ann Arbor, Mich., are consulting engineers.

CHICAGO, ILL.—Commonwealth Edison Company has filed plans for two-story addition to power substation at 1128 Ardmore Avenue, including installation of equipment for increased capacity. Cost over $85,000.

INDIANAPOLIS, IND. — Indianapolis Railways, Inc., 110 North Illinois Street, receives bids until December 1, for erection of three-unit motor bus service, repair and storage plant on West Washington Street. Installation will include motors and controls, electric hoists, conveyors and other equipment. Cost about $700,000, with equipment. Herbert Foltz, Architects and Builders Building, is architect; Bevington-Williams, Inc., Indiana Pythian Building, is consulting engineer.

MOUNT AUBURN, IOWA — Benton County Rural Eletcric Co-Operative, Inc., Mount Auburn, recently organized, plans primary and distributing lines in parts of Benton County, totaling about 180 miles, with power substation and service facilities. Fund of $200,000 has been secured through Federal aid. Bids will be asked soon. At later date, system will be increased to over 400 miles.

TUCSON, ARIZ.—Tucson Gas, Electric Light & Power Company has taken out permit for new steam-operated electric generating plant on West Sixth Street and will proceed with foundations at once. Cost reported over $175,000.

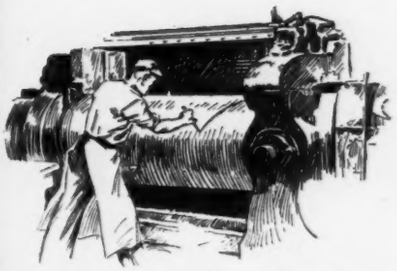
BALTIMORE, MD.—Bethlehem Steel Company, South Bethlehem, Pa., plans installation of large capacity heavy-duty motors, smaller mill motors, starting and controlling equipment, regulators, panel boards, electric hoists, conveyors, electric cranes and other equipment in new steel strip and tinplate mill at plant at Sparrows Point, Baltimore. New unit is scheduled for completion in 1937. Cost close to $6,000,000.

MIDDLESBORO, KY.—Will take bids soon for municipal electrical distribution system, including transmission line for connection with high-tension system of TVA for power supply, outdoor power substation with transformers, switchgear and accessory equipment. Bond issue of $175,000 has been voted. J. S. Watkins, Citizens' Trust Building, Lexington, Ky., is consulting engineer.

LA GRANGE, ILL.—Electro-Motive Corporation, La Grange, plans installation of heavy-duty motors and controls, smaller mill motors, conveyors, electric hoists and other equipment in new addition to diesel locomotive works. Cost about $700,000. Company is a subsidiary of General Motors Corporation, Detroit, Mich.

# ROEBLING

## Rubber Insulated Cables



*Sketch of our 84" Rubber Sheeting Mill, one of the many modern operations in the making of Roebling Rubber Insulated Cable.*

Shown is only one of the Roebling Line of rubber Insulated Wires and Cables. They are made in a variety of insulated compounds to exactly meet a wide range of requirements such as, power transmission, railway signalling, building wiring and many other purposes.

Plain Rubber 60% Sheath Power Cable. "SAFECOTE" Rubber-insulated and Braided Wires and Cables: Code, Intermediate, 30% and 40% Performance, 35% and 40% Performite. 40% and 60% Sheath Flexible Cords. Parkway, Service, Mining, Welding, and Control Cables; Tree Wire.

These will give you a fair idea of the completeness of the Roebling Line. They are made in a wide range of sizes and voltages. Armors:—steel, zinc, or bronze tape, or round steel wire.

JOHN A. ROEBLING'S SONS CO.
Trenton, N. J. *Branches in Principal Cities*

## OVER 60 OTHER TYPES

*Power Cables; Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables; Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Slow Burning Wires and Cables » Weatherproof Wires and Cables » Submarine Cables » Portable Cords » And a wide variety of other wires and cables.*

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**ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING**

Reliable

STRAIGHTLINE SPLICE

If the lineman can push the wire into the Splice, the wire is in to stay.

Ends fitting wire closely prevent insertion of wires that are burred or out of shape — prevent insertion of oversized wires — eliminating possible troubles.

Splices develop approximately 100% strength of solid wires and approximately 98% on seven strand.

Made entirely of non - corrosive parts — can be cleaned and re-used.

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

# Municipal Plants

NEODESHA, KAN.—In a decision handed down recently the Kansas Supreme Court held that the electric power and light plant is exempt from taxation notwithstanding the fact that a portion of its transmission lines extend beyond the city limits for a distance of 4 miles into Montgomery County. The plant is in Wilson County. The decision was in a case in which a writ of mandamus was asked to direct the Montgomery county clerk to levy a tax against the transmission lines and distributing system belonging to the city of Neodesha. The case was of more than local importance because Richard L. Becker, Montgomery county attorney, who filed the writ, declared that electric lines in Kansas belonging to other municipally owned plants, carry a value of $75,000,000 and have been escaping taxation. The Supreme Court decision held that such properties may not be taxed. The decision stated that in the opinion of the court such municipal transmission lines should be subjected to taxation, but that under the Kansas law as it now stands they are plainly exempt.

KENTUCKY—Three Kentucky communities voted in favor of municipal power plants at the recent election. Owenton voted 302 to 153 in favor of a $75,000 bond issue to finance construction of a municipal light and power plant. Glasgow voted 1,002 to 798 to authorize issuance of $200,000 in revenue bonds for construction of power plant. The Kentucky Utilities Company franchise expires November 26. Williamstown indorsed 522 to 50 a proposal to construct a municipal power plant to serve the city and sections of Grant County. Middlesboro authorized a $175,000 bond issue for a distributing system, which will use T.V.A. power.

ASHLAND, KY.—City Commission has accepted a new electric light and power franchise offered by the West Virginia & Kentucky Power Company. Automatically the city's present francise is canceled. The new franchise, according to officials of the power company, will save the city $46,000 over a ten-year term.

CAMPBELL, MO.—A six-year battle over construction of a municipal light plant at a cost of $76,000 ended when the Arkansas-Missouri Power Company discontinued distributing electric energy on November 2. Final action was taken when the council turned down a proposal of the company to buy at wholesale figures electric energy from the lines operating throughout this district and fed by the power plant at Walnut Ridge.

MCCOOK, NEB.—Dr. G. M. Welch, president of the McCook Public Power District, recently stated that the project will have to obtain the approval of the voters before it can use a $101,300 P.W.A. grant for a light and power plant. He said the city will be required to supplement the federal grant with approximately $360,000 to be obtained through a bond issue, which also must be approved by the voters and repaid from the plant's income.

EAST LIVERPOOL, OHIO.—Electors at the recent election voted down a proposition to erect a municipal light plant by a majority of 2,121. The vote was 5,554 against 3,434.

JACKSON, TENN.—Due to a court injunction the proposed $663,500 municipal electric distribution system has been postponed indefinitely. The project was to include an electric distribution system to tie in with the T.V.A. system together with the necessary substations, etc. Recently the P.W.A. approved a $364,000 loan and $299,500 grant for this project.

SOUTH NORFOLK, VA.—Justice Joseph W. Cox of the federal district court in Richmond has issued an order temporarily restraining Public Works Administrator Ickes from granting $148,000 to the city of South Norfolk to aid in constructing a light, heat and power plant and distribution system. The order was issued in a suit filed by the Virginia Electric & Power Company. The city originally sought a loan and grant of $218,700 to defray partially the cost of a $486,000 plant and distributing system and later was allocated $148,000 grant. The power company told the court it had franchises in South Norfolk and Norfolk County during 1935 to serve 130,000 customers; that the company had gross revenues of $10,355,000 and an investment of $74,000,000 which would be affected.

SHULLSBURG, WIS.—After a rehearing requested by the Interstate Light & Power Company, the Wisconsin Public Service Commission affirmed its July 30 order fixing a price of $18,000 on the company's local plant, which the city desires to purchase.

VIROQUA, WIS.—At a recent meeting of the city council all action that had been taken in regard to the purchase of the local plant and distribution system of the Northern States Power Company was rescinded. Petitions against the proposal were signed by many voters and presented to the Council. No referendum, therefore, was held at the recent election.

•

# Recent Rate Changes

LOUISVILLE GAS & ELECTRIC COMPANY has announced through its president, T. Bert Wilson, an annual reduction of $50,000 in rates for users in Jefferson County, exclusive of Louisville, as the result of a new twenty-year franchise which the company bought from the County Commission. The utility had been serving Jefferson County without a franchise since October 5, 1935, when a previous twenty-year franchise expired. The city rates had been reduced in the meantime, but the county rates remained at the old scale. The reduction was brought about by a provision of the new franchise making the county gas rate the same as the city, and limiting the county electric rate to 1 cent per kilowatt-hour higher than the city rate. After 100 kw.-hrs. of electricity are used in the county the rate becomes 2½ cents the same as the city. The city gets a lower rate when the next 200 kw.-hr. are passed, however. The county commercial rate is 1 cent over the city schedule in each bracket.

WISCONSIN PUBLIC SERVICE COMMISSION has announced that it has begun a study of Wisconsin Power & Light Company's depreciation rates as the first step in an investigation which will take in all major electric utilities operating in the state.

FULTON LIGHT, HEAT & POWER COMPANY has filed revisions of its electric rate schedule with the New York Public Service Commission which reduces charges of a wholesale industrial rate so as to save five large users about $23,800 a year and permits the serving of special contract customer under the revised rate. The commission permitted the revised rate to become effective November 1 in the city of Fulton and town of Granby and Volney in Oswego County.

APPALACHIAN ELECTRIC POWER COMPANY has advanced to the city government of Huntington, W. Va., a proposal to reduce the municipal street lighting rate 25 per cent

# INSTRUMENT TRANSFORMERS

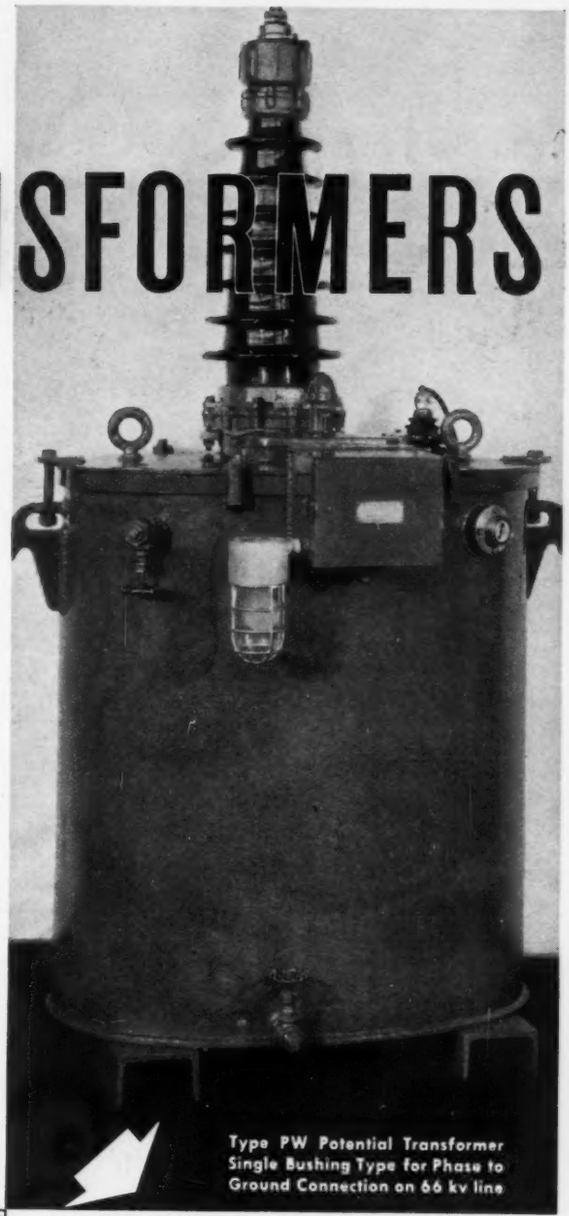
## FOR RELAY AND CONTROL CIRCUITS

Instrument Transformers for use in connection with Relay and Control circuits require special consideration in their design. A background of 20 years experience in solving problems in connection with the design of Current and Potential Transformers for many varying applications, assures the purchaser of Allis-Chalmers' Instrument Transformers a product properly adapted for the application.

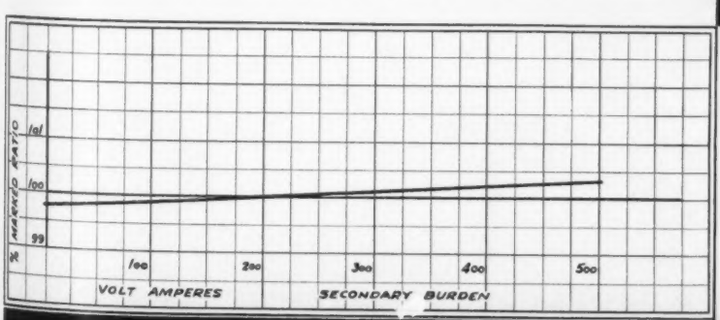
•

THE ALLIS-CHALMERS LINE *of Instrument and Metering Transformers is complete, including:*

**INDOOR CURRENT TRANSFORMERS** (Wound, Thru, or Bar Types)
**OUTDOOR CURRENT TRANSFORMERS**
(Dry Type, Compound Filled, Oil Filled)
**INDOOR POTENTIAL TRANSFORMERS**
(Dry or Oil Filled—Fused or Unfused)
**OUTDOOR POTENTIAL TRANSFORMERS**
(Dry Type, Compound Filled, Oil Filled)
**METERING OUTFITS** (Dry or Oil Filled) **METER CABINETS**



Type PW Potential Transformer Single Bushing Type for Phase to Ground Connection on 66 kv line




The services of our Engineers are available in connection with any problems involving Relay and Control circuits. Send for Bulletin No. 152 which fully describes these better Instrument Transformers.

TRANSFORMER DIVISION

# ALLIS·CHALMERS

MILWAUKEE WISCONSIN

:ANOTHER YEAR ROLLS BY . . .
RUST-TOX
Still Stands Up
This unretouched photo (taken August 7, 1935) demonstrates how RUST-TOX eliminates expensive rust-removal and gives a longer-life paint job. The Ohio Public Service Co. says of this spot coating: "RUST-TOX, pigmented with aluminum, was applied in August, 1932...paint film still in good condition . . . no evidence of corrosion."
Discover for yourself the money-saving RUST-TOX method of painting rusted metal WITHOUT REMOVING THE RUST.
Complete Data and Samples on Request.
THE SKYBRYTE CO.
Cleveland, Ohio
Introductory orders accepted at the barrel price ($2.50 per gal. unpigmented)
F.O.B. Cleveland

THIS new instrument vastly simplifies the job of determining the direction of phase rotation on a three-phase supply. It will be found practically indispensable where metering equipment is concerned. Test engineers have many opportunities to make advantageous use of the new Ferranti Phase Rotation Indicator.

Operation is extremely simple. Red, yellow and blue handles on the crocodile clips distinguish the phases to which they should be attached. Direction of rotation of the disc in the indicator tells at once whether phase marking is correct. Unmarked bus-bars or leads can also be marked correctly by determining phase rotation with the Ferranti Indicator.

Write at once for detailed specifications of this new, highly useful instrument.

FERRANTI ELECTRIC, INC. 30 Rockefeller Plaza NEW YORK CITY


in exchange for a new franchise to run ten years. The proposed reduction would reduce lighting costs about $10,000 a year.

ROCKLAND LIGHT & POWER COMPANY has filed revisions of electric rates with the New York Public Service Commission which is estimated to save consumers in its territory about $53,711 annually. The commission permitted the rates to go into effect in the territory which is divided into two divisions and different rates are applicable in each division. The territory covers portions of Rockland, Orange and Sullivan Counties.

## Records Phase Angle Between Stations

[*Continued from page 52*]

ured, this error must be either compensated for, as in this case, or a circuit must be used in which this error is balanced out.

Tests have shown that the resistance of the telephone line changes approximately 8 to 10 per cent from winter to summer temperatures. This will cause several degrees change in the 1,800-ohm line between the two stations, and it, therefore, becomes quite important that the circuit be checked every few days and readjustments made in the compensator if necessary. Ordinarily, the adjustments are accomplished by reference to specially prepared curves showing the relation between the pilot feeder load and phase displacement. However, periodically, the pilot feeder is used with a zero load condition as a primary check.

Although the present method of compensating for telephone circuit resistance and reactance rather than balancing it out by use of some other method requires considerable maintenance, it involves the use of only one instrument and one less leased telephone circuit, which is more simple than the other methods investigated. Therefore, used with caution, the present method is to be recommended.

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## Municipal Plants Urged at Quebec Meeting

Distribution of electric power to municipalities in Quebec by a provincial organization and at "lowest possible rates" was recommended by the Union of Quebec Municipalities at its recent annual meeting in Quebec.

Establishment of provincial hydro plants or purchase of an established hydro company by the government would be the proper means of effecting the proposed scheme, according to a resolution sponsored by Mayor J. E. Gregoire of Quebec, which the meeting adopted.